

Health and Safety Plan Soil and Groundwater Sampling Activities

Fansteel Inc.
North Chicago, Illinois

Project No. 6109A
March 2001

US EPA RECORDS CENTER REGION 5



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Earth Sciences Consultants, Inc.

Providing Environmental Consulting Services Since 1979

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**Health and Safety Plan
Soil and Groundwater Sampling Activities
Fansteel Inc.
Number One Tantalum Place
North Chicago, Illinois**

1.0 Introduction

This site-specific health and safety plan has been prepared in accordance with the requirements of Occupational Safety and Health Administration (OSHA) including 29 Code of Federal Regulations (CFR) 1910.120 and the corporate policies of Earth Sciences Consultants, Inc. (Earth Sciences). The health and safety plan addresses the risks to employee health and safety that may be present during soil and groundwater sampling activities being conducted by Earth Sciences at the Fansteel Inc. (Fansteel) site located at Number One Tantalum Place in North Chicago, Illinois. This health and safety plan also presents the measures that will be taken to evaluate and control those risks. This plan covers all Earth Sciences' personnel at the site. Subcontractors of Earth Sciences may be covered by their own health and safety plans provided they have been approved in advance by the Health and Safety Manager.

Work activities covered under this health and safety plan include the following:

- Surface and subsurface soil sampling.
- Installation of temporary groundwater monitoring wells.
- Sampling of groundwater monitoring wells.

Site operations will be conducted in accordance with applicable regulations. Site work will be performed in a workmanlike manner consistent with standards of good practice for the operations. Evaluation of additional site hazards, subcontractor health and safety plans, and compliance with this health and safety plan will be determined by the Health and Safety Manager on an as-needed basis.

2.0 Key Personnel and Responsibilities

The following personnel will have administrative and operational responsibilities for activities covered by this health and safety plan:

- Robert D. Breakwell - Project Manager - The Project Manager has overall responsibility for the preparation, approval, and implementation of general site operations including this health and safety plan.
- Donna L. Wilson - Health and Safety Manager, Earth Sciences. Ms. Wilson will provide technical assistance to the Health and Safety Officer on site including evaluations of and changes to this health and safety plan required by unexpected site situations. She will also provide oversight in matters concerning health and safety.
- To Be Determined - Project Geologist - The Project Geologist has responsibility for the development of site operations, the conduct of field operations, and technical matters concerning this project.
- To Be Determined - Site Health and Safety Officer - The Health and Safety Officer will conduct or assign the daily health and safety activities associated with site operations. He will coordinate on-site health and safety activities and report to the Health and Safety Manager on matters of worker health and safety.

At least one person with operational responsibility for the implementation of this plan will be on the site whenever project personnel or their subcontractors are performing tasks governed by this plan. In addition, at least one person with administrative responsibility for health and safety will be on site or available on call whenever project personnel or their subcontractors are performing project-related activities at the site.

All Earth Sciences' personnel and their subcontractors are required to comply with the following:

- Adhere to all aspects of this health and safety plan.
- Follow instructions oriented to general site safety issues as well as the items specified in this health and safety plan.
- Notify the Site Health and Safety Officer of any hazardous or potentially hazardous conditions or situations encountered at the site.
- Possess and maintain any training certifications required by OSHA for the tasks being performed at the site.

3.0 Task Description and Hazard Evaluation

The tasks identified in Chapter 1.0 are described and defined in greater detail in this chapter of the health and safety plan. Known hazards associated with each task to be conducted and the site in general are identified. Strategies used for the minimization or elimination of employee exposures to these hazards are addressed. Some level of personal protective equipment (PPE) will be required during site operations. This level of protection is anticipated to be Level D for most operations. Dermal protection (modified Level D) may be added as required by specific operations. Level C protection may be required in certain areas where chemical contamination has been identified. Increased levels of protection may be required in areas where increased levels of contamination are found or predicted.

Level B protection will be required in areas of oxygen deficiency. Areas of high level contamination where the concentration of the contaminants of concern exceed ten times the permissible exposure level (PEL) will also require Level B protection. These conditions and conditions immediately dangerous to life and health (IDLH) are not covered by this health and safety plan. Written amendments to this health and safety plan are required for operations requiring Level B or Level A protection.

3.1 Hazardous Materials

The operations at the site are expected to involve disturbance of areas of surface and subsurface soils. Preliminary investigations have been conducted and the nature of the contaminants of concern at the site have been determined. Additional knowledge of the contaminants of concern is based on the operations and raw materials utilized at the facility during operations. Decontamination chemicals are also a potential source of contact with hazardous materials.

The following list contains the anticipated contaminants of concern presented by the site.

- Volatile Organic Compounds (VOC). VOCs have been found in site soils, and waters. Analysis of samples has yielded detectable quantities of acetone, benzene, carbon disulfide, dichloroethenes, methylene chloride, tetrachloroethene, trichloroethene, and vinyl chloride in the site materials. Additionally, decontamination solvents such as acetone, hexane, and methanol may be used at the site. Individually carbon disulfide, dichloroethenes, methylene chloride, trichloroethene, and vinyl chloride present significant risks of exposure. Acetone, hexane, and/or methanol may be required to remove oily substances from equipment. The potential total VOC concentrations generated by site operations present a risk of exposure by inhalation of vapors and/or dermal absorption
- Polycyclic Aromatic Hydrocarbons (PAH). PAHs can be absorbed directly through intact skin. Many materials in this chemical category are known or suspect human carcinogens. These materials can cause chemical skin burns and photosensitization. These products are

anticipated to be bound in soil. Soils or waters may become aerosolized by drilling operations. Since PAHs have high boiling point and low vapor pressures, it is not anticipated that the materials will be vaporized. Free liquid materials are not anticipated to be present at the site.

- **Petroleum Hydrocarbons and Oils** - Petroleum hydrocarbons and oils are included among the suspected contaminants on the site. Liquid materials may be volatilized by site operations. The low concentrations of these materials are not anticipated to present a health and safety concern.
- **Metals** - Metallic contaminants, specifically lead, tantalum, and cadmium, are among the suspected contaminants on the site. These metals may be present in metallic, salt, or dissolved forms. Cadmium is considered to be an occupational carcinogen. Lead is known to affect the nervous system, gastrointestinal system, and the kidneys. Tantalum is a respiratory and skin irritant. The concentrations of these metals are not anticipated to present a health and safety concern if dust levels are maintained below the action level of 0.75 milligram per cubic meter.
- **Acids** - Dilute mineral acids, specifically 5 percent nitric acid, may be used in the decontamination process to remove trace metal contamination from equipment.
- **Oxygen Deficiency** - Entry into spaces where the atmosphere is potentially oxygen deficient is not anticipated during site operations.

3.1.1 Evaluation of Hazardous Materials

The materials present on the Fansteel site vary in concentration and toxicity. The hazards associated with the presence of VOC are related to dermal contact, inhalation, and ingestion. The hazards associated with metals are through inhalation and ingestion of dusts containing the metals. PAH hazards are principally associated with dermal absorption and inhalation of dusts contaminated with PAHs.

3.1.1.1 Inhalation Hazards

The potential for exposure to toxic vapors or dusts is a concern at this site. Site soils are known to be contaminated with VOCs, PAHs, and metals.

3.1.1.1.1 VOC

The general organic vapor action level specified in Chapter 5.0, PPE, for the use of respiratory protection is 5 parts per million (ppm) and the evacuation level is of 25 ppm. Vinyl chloride has a PEL of 1 ppm. None of the other anticipated VOCs has a PEL less than 5 ppm. Periodic air monitoring will be conducted to ensure that workers are not exposed to VOC concentrations in excess of the PEL.

The use of organic solvents for decontamination is also possible. The solvents used for decontamination have PELs significantly higher than the 5 ppm action level specified in Chapter 5.0, PPE requiring respiratory protection. Air monitoring for organic vapors will be conducted in areas where organic solvents are being used for decontamination purposes.

Table 3-1 lists the contaminants of concern at the site that may be present in concentrations presenting health and safety concerns for workers. The table also lists PEL and threshold limit values (TLV) for these materials. Health hazards and first aid steps are also presented in the table. More detailed information is provided by the National Institute for Occupational Safety and Health (NIOSH) Quick Guide information attached to this health and safety plan.

3.1.1.1.2 Metals

Cadmium, lead, and tantalum are the metals presenting potential health hazards at the site if dust levels are not controlled. Respiratory protection will be required if dust levels in the work areas exceed 0.75 milligram per cubic meter. Respiratory protection guidelines are presented in Chapter 5.0, PPE.

Table 3-1 lists the contaminants of concern at the site that may be present in concentrations presenting health and safety concerns for workers. The table also lists PEL and TLV for these materials. Health hazards and first aid steps are also presented on the table. More detailed information is provided by the NIOSH Quick Guide information attached to this health and safety plan.

3.1.1.1.3 PAHs

PAHs, as a chemical class, contain several known or suspect human carcinogens. These large semivolatile organic compounds are present in the dusts and soils at the site. These chemicals may present potential health hazards at the site if dust levels are not controlled. Respiratory protection will be required if dust levels in the work areas exceed 0.75 milligram per cubic meter. Respiratory protection guidelines are presented in Chapter 5.0, PPE.

Table 3-1 lists the contaminants of concern at the site that may be present in concentrations presenting health and safety concerns for workers. The table also lists PEL and TLV for these materials. Health hazards and first aid steps are also presented in the table. More detailed information is provided by the NIOSH Quick Guide information attached to this health and safety plan.

3.1.1.1.4 Oxygen Deficiency

The potential for exposure to oxygen-deficient environments is a concern at sites where the accumulation of vapors may occur or when confined spaces will be entered. Pits, excavations, trenches, and areas below grade present the potential for exposure to an oxygen-deficient environment. Excavations and similar areas will be entered during site operations. Air monitoring will be conducted prior to entry into such areas as described in Chapter 7.0, Environmental Monitoring.

3.1.1.2 Dermal Hazards

The potential for dermal absorption of the contaminants of concern is a concern at the Fansteel site. Organic and chlorinated solvents and PAHs which could be directly absorbed across intact skin are among the contaminants of concern. These solvents may also potentiate the absorption of metals that are not normally absorbed across the skin barrier.

Physical contact with the contaminants of concern will be kept to a minimum. Operations will be conducted using methods which reduce or eliminate the necessity for contact with the materials. Gloves and other dermal protection will be utilized to further reduce the potential for physical contact with the materials. Workers leaving the contaminated areas to use the lavatory must decontaminate to reduce the potential for dermal contact with the materials.

3.1.1.3 Ingestion Hazards

The contaminants of concern present an ingestion hazard. The primary route of exposure for lead is by ingestion. The potential for the ingestion of site materials will be reduced by the use of gloves and personal hygiene. Smoking, eating, chewing, or drinking in the work areas of the site is prohibited. Workers leaving the contaminated areas for breaks, meals, or after work should wash their hands and faces to reduce the potential for the accidental ingestion of materials.

**Table 3-1
Chemical Hazards**

Contaminant of Concern	PEL/TLV (ppm in air)	IDLH (ppm in air)	Health Hazards	First Aid
Acetone	1000/750	2,500	Irritant, headache, Dizziness.	Irrigate eyes with water. Wash skin with soap. Provide respiratory support. Medical attention if swallowed.
Benzene	1/0.5	500	Carcinogen irritant, nausea, headache, fatigue, bone marrow depression.	Irrigate eyes with water. Wash skin with soap. Provide respiratory support. Medical attention if swallowed.
Cadmium	5 µg/m ³ 2 µg/m ³	9 mg/m ³	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia, carcinogen.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.
Carbon Disulfide	20/10 [skin]	500	Dizziness, headache, poor sleep, fatigue, nervousness, anorexia, weight loss, psychosis, polyneuropathy, Parkinson-like syndrome, ocular changes, coronary heart disease, gastritis, kidney, liver injury, eye, skin burns, dermatitis; reproductive effects.	Irrigate eyes with water. Wash skin with soap. Provide respiratory support. Medical attention if swallowed.
1,1-Dichloro- ethene	None/5	Not Determined	Irritation eyes, skin, throat, dizziness, headache, nausea, dyspnea; liver, kidney dysfunction, Pneumonitis, carcinogen.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.
1,2-Dichloro- ethene	200/200	1,000	Irritation eyes, Respiratory System, Central Nervous System, depressant/depression	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.

Contaminant of Concern	PEL/TLV (ppm in air)	IDLH (ppm in air)	Health Hazards	First Aid
Hexane	500/50	5,000	Irritant headache, nausea, numbness of extremities.	Irrigate eyes with water. Wash skin with soap. Provide respiratory support. Medical attention if swallowed.
Lead	50 $\mu\text{g}/\text{m}^3$ 50 $\mu\text{g}/\text{m}^3$	100 mg/m^3	Weakness, lassitude, insomnia, facial pallor; anorexia, weight loss, malnutrition, constipation, abdominal pain, colic; anemia, gingival lead line, tremor, paralysis wrist, ankles, encephalopathy; kidney disease, irritation to eyes, hypotension.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.
Methanol	200/200	25,000	Eye irritant, headache, nausea, vomiting. May cause blindness if swallowed.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.
Methylene Chloride	25/50	2,300	Irritation to eyes, skin; fatigue, weakness, somnolence, lightheadedness; numbness, tingle limbs; nausea; carcinogen.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.
Nitric Acid	2/2	100	Eye and skin irritant, pulmonary edema, dental erosion.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.
Polycyclic Aromatic Hydrocarbons as Coal Tar Pitch Volatiles	0.2 mg/m^3 0.2 mg/m^3	80 mg/m^3	Dermatitis, bronchitis, carcinogen.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.
Tantalum	5 mg/m^3 5 mg/m^3	2,500 mg/m^3	Irritation to eyes, skin; in animals: pulmonary irritation.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.

Contaminant of Concern	PEL/TLV (ppm in air)	IDLH (ppm in air)	Health Hazards	First Aid
Trichloroethylene	100/50	1,000	Irritation to eyes, skin; headache, vertigo; visual disturbance, fatigue, giddiness, tremor, somnolence, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; carcinogen.	Irrigate eyes with water. Wash skin with soap and water. Provide respiratory support. Medical attention if swallowed.

3.2 General Protection and Monitoring

A program of routine monitoring for the presence of hazardous materials determined to be present at the site will be implemented. The purpose of this monitoring is to minimize the potential for any employee to be inadvertently exposed to excessive levels of chemical contaminants. Monitoring for oxygen-deficient atmospheres will be conducted as specified in the following Sections 3.2.1 and 3.2.2. The monitoring program contents are discussed in greater detail in Chapter 7.0, Environmental Monitoring.

3.2.1 Preliminary Air Monitoring

Areas where airborne chemical hazards are anticipated will be monitored for the contaminants of concern prior to the entry of workers onto those site areas. Enclosed areas will be monitored prior to initial entry for the presence of organic vapors, combustible atmospheres, and adequate oxygen using the instruments and procedures described in Chapter 7.0, Environmental Monitoring. Since the majority of site work is to be conducted in well-ventilated areas or the open air, the accumulation of dangerous levels of organic vapors or reduced levels of oxygen is not anticipated. The level of organic vapors anticipated on site is not expected to result in off-site migrations of any significance.

Preliminary dust monitoring may be conducted to determine the levels of dust present when operations are not occurring. It is not anticipated that this monitoring will be required for health and safety considerations. The level of dust anticipated on site is not expected to result in off-site migrations of any significance.

Accumulation of vapors not associated with the contaminants of concern may occur in areas with poor natural or artificial ventilation. Oxygen-deficient environments and combustible atmospheres are also a concern in confined spaces. All such areas will be monitored for low oxygen content and combustible atmospheres prior to initial entry. Continuous or periodic air monitoring will be conducted when work is

being performed in these areas. Entry into areas where an IDLH environment exists, including confined space entry, is prohibited under this health and safety plan.

3.2.2 Routine Site Air Monitoring

Areas where contaminated dusts, soils, or other materials are being processed will be monitored on a regular basis for the presence of organic vapors and dusts. Soils brought to the surface from soil borings and monitoring well installations may be monitored for organic vapors as part of the sampling plan. The frequency for such monitoring will be determined by the Site Health and Safety Officer, the Health and Safety Manager, and the nature of the work being conducted. The instruments utilized for these tests will be similar to those used for the preliminary air monitoring and as described in Chapter 7.0, Environmental Monitoring.

Dust monitoring may be conducted in areas where there is the potential for contaminated dusts to become airborne. Areas prone to the generation of dust may be controlled by preventative engineering means such as misting. Dust monitoring should not be conducted immediately following such activities, since the water droplets may be interpreted by the monitor as dusts. Dust monitoring may be conducted on a real-time basis or using standard industrial hygiene or environmental techniques.

Personal monitoring, in addition to area monitoring, may be required depending on the concentration of the contaminants of concern and the potential to expose workers. The potential for exposure of workers to the contaminants of concern in concentrations in excess of the PEL is remote. Since work will not be conducted in atmospheres where the concentration of contaminants exceeds the PEL, personal monitoring is not planned for the site. Personal air monitoring may be required at the discretion of the Site Health and Safety Officer or the Health and Safety Manager to prevent or reduce worker exposure and to ensure compliance with OSHA regulations.

3.3 Hazards of Site Operations

The work activities listed below are anticipated to occur on the site.

- Surface and subsurface soil sampling.
- Installation of temporary groundwater monitoring wells.
- Sampling of groundwater.

The hazards associated with each task will be described in the following sections. PPE requirements will be discussed as well as air monitoring requirements for health and safety.

3.3.1 General PPE Requirements

The level of PPE anticipated for most site operations is Modified Level D. If air monitoring indicates the need for respiratory protection during the performance of this task, Level C protection will be used. Conditions requiring the use of Level B protection (supplied air respirators) are not anticipated for this site. Such conditions will result in the evacuation of the site until safe conditions are achieved.

- Suitable work clothing. Tyvek protective garments may be required whenever exposure to potentially hazardous materials is expected or possible. Liquid, semisolid, or wet materials are expected to be encountered which will require the use of coated Tyvek garments.
- Work gloves capable of providing adequate physical protection to resist punctures, tears, and cuts. Additionally, latex gloves and/or nitrile gloves will be required to prevent contamination of the skin with soils and contaminants of concern. Hand protection will be selected and utilized as prescribed under OSHA regulations, 29 CFR 1910.138.
- Hard-toe boots which have sufficient sole strength to resist punctures are required for site operations. Protective footwear must comply with 29 CFR 1910.136/29 CFR 1926.96 and American National Standards Institute (ANSI) Standard Z41. Waterproof and/or chemically-resistant boots may also be required to prevent contamination of the skin or work boots and to reduce the possibility of contamination from being removed from the site.
- Hard hats meeting ANSI Standard Z89.1 and 29 CFR 1910.135/29 CFR 1926.100 are required for site operations. Hard hats are to be worn by personnel working with or around mobile-powered equipment or equipment capable of launching projectiles including drill rigs. Hard hats are also required when working in areas where falling objects or bump hazards could cause head injury.
- Eye protection consisting minimally of safety glasses meeting ANSI Standard Z87 and 29 CFR 1910.133/29 CFR 1926.102 are required during site operations. Additional eye and face protection such as a face shield or goggles may be required if flying debris is expected or if liquid contamination is encountered.
- Hearing protection will be required for equipment operators and for workers in the immediate vicinity of drill rigs. It may also be required for other workers based on the recommendation of the Site Health and Safety Officer if potentially harmful noise levels are encountered.
- Respiratory protection will be required in all operations that may generate potentially hazardous dusts, mists, or chemical vapors. This will consist of at least half-face respirators with appropriate combination High-Efficiency Particulate Air (HEPA)/P-100 filter/organic vapor/acid gas/ammonia/amines cartridges, or other equipment as specified by the Site Health and Safety Officer.

3.3.2 Surface and Subsurface Soil Sampling

Surface and subsurface soil investigations conducted at the site will include the collection of soil samples from a variety of depths using manual and/or mechanical soil boring techniques. The potential hazards of these procedures include the following:

- Physical contact with the contaminants of concern.
- Exposure to airborne chemical vapors or materials.
- Work with and around mobile-powered equipment, specifically drilling rigs.
- Contact with chemical decontamination agents.

Appropriate PPE will be worn when sampling soil or other materials that may contain chemical constituents as described in Section 3.3.1 and Chapter 5.0, PPE. Air monitoring will be conducted to determine the need for respiratory protection. The use of respiratory protection will be determined by the site Health and Safety Officer based on air monitoring and the action levels presented in Table 5.1.

Equipment operators will be trained and experienced on the types of equipment being used. Operators must be aware of the surroundings, especially the locations of overhead and underground utilities. Every effort will be made to identify and locate underground utilities prior to digging. If soils are to be excavated in areas near underground utilities or if the location of the utilities is unknown, the operator will use extra care in the performance of this task.

Personnel may be working in proximity to heavy equipment. Both the operators and ground level personnel must exercise caution to avoid accidents. Separate traffic and pedestrian lanes will be established when possible. PPE may inhibit movement and increase the response time needed for workers to move out of the way of vehicles or for operators to respond. Operators must be aware that hearing protection may prevent workers from hearing approaching vehicles.

Backup alarms must be used on heavy equipment. Alarms must not be disabled, disconnected, or otherwise rendered inoperable. Equipment with defective or missing backup alarms shall not be used.

During intrusive activities such as subsurface soil sampling, suitable monitoring for oxygen, explosive environments, and organic vapors will be conducted by the Health and Safety Officer or a designated and trained representative of the Health and Safety Officer at a frequency determined by the Health and Safety Officer. The environmental monitoring program and the instrumentation to be used are discussed in Chapter 7.0, Environmental Monitoring.

3.3.3 Installation of Temporary Groundwater Monitoring Wells

The hazards associated with these tasks are similar to those described in the previous Section 3.3.1. Sampling of soils may be conducted as part of the well installation process. The presence of liquid materials may require the use of coated coveralls, splash suits, goggles, and/or face shields.

Appropriate PPE will be worn when installing and developing monitoring wells that may contain chemical constituents as described in Section 3.3.1 and Chapter 5.0, PPE. Air monitoring will be conducted to determine the need for respiratory protection. The use of respiratory protection will be determined by the Site Health and Safety Officer based on air monitoring and the action levels presented in Table 5.1.

3.3.4 Sampling of Groundwater

The hazards associated with these tasks are similar to those described in the previous Sections 3.3.1 and 3.3.2. Sampling will involve bringing groundwater to the surface. Precautions must be taken when electrical equipment is used in the area where water is present. All electrical equipment must be properly grounded. Equipment used for the purpose of determining liquid levels in the wells must be properly grounded and designed for use in wet areas.

Appropriate PPE will be worn when sampling groundwater or other materials that may contain chemical constituents as described in Section 3.3.1 and Chapter 5.0, PPE. Air monitoring will be conducted to determine the need for respiratory protection. The use of respiratory protection will be determined by the Site Health and Safety Officer based on air monitoring and the action levels presented in Table 5.1.

3.4 Thermal Stress

Personnel at the Fansteel site may be subjected to thermal stress in the form of heat stress or cold stress depending on the environmental conditions at the site on any given day. Heat stress can develop even on cold days when PPE prevents evaporation of perspiration or if labor is unusually strenuous or excessive for the particular employee. Cold stress may occur when ambient temperatures are low or if the site is excessively windy, if wet conditions prevail, or if the site is subject to a lake effect caused by proximity to large bodies of water.

3.4.1 Heat Stress

Personnel wearing PPE are at increased risk of developing heat stress. Individuals vary in their susceptibility to heat stress. Workers at risk of heat stress will be monitored under the direction of the Health and Safety Officer. At a minimum, the Site Health and Safety Officer will be trained in the monitoring techniques. Additional training such as first aid and cardiopulmonary resuscitation (CPR) may also be required.

3.4.1.1 Permeable Work Clothes

For workers wearing permeable clothing, Earth Sciences will utilize the monitoring requirements and suggested work/rest schedules recommended in the current American Conference of Government Industrial Hygienists (ACGIH) Threshold Limit Values for Heat Stress as guidance for controlling potential heat stress.

The type of work anticipated for this site will be in the moderate range. Workers in permeable clothing should be able to perform continuous work if the ambient temperature is not in excess of 75°F. Measurement and calculation to determine the wet bulb globe temperature (WBGT) will be conducted by the Health and Safety Officer, if ambient temperatures are in excess of 75° F. The WBGT will be used in accordance with the ACGIH screening criteria presented in Table 3-2 to determine the need for adjustments to the work/rest schedule. It is assumed that the workers are wearing permeable clothing. If WBGT is not available, the guidelines for workers wearing impermeable clothing will be used.

Table 3-2
Screening Criteria for Heat Stress Exposure
(WBGT Values in °C)

	Acclimatized				Unacclimatized			
Work Demands	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
Continuous	29.5	27.5	26.0		27.5	25.0	22.5	
75 percent work 25 percent rest	30.5	28.5	27.5		29.0	26.5	24.5	
50 percent work 50 percent rest	31.5	29.5	28.5	27.5	30.0	28.0	26.5	25.0
25 percent work 75 percent rest	32.5	31.0	30.0	29.5	31.0	29.0	28.0	26.5

3.4.1.2 Impermeable Work Clothing

For workers wearing semipermeable or impermeable PPE, the ACGIH standard cannot be applied in a straightforward manner. For these situations, workers will be monitored when the ambient dry bulb temperature in the work area is above 75°F. The monitoring techniques may include the following:

- Heart Rate - Count the radial pulse during a 30-second period as early as possible in a rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, the next work cycle will be shortened by one third.
- Oral Temperature - Using a clinically-approved thermometer or other device, measure the oral temperature at the end of the work period. If the oral temperature exceeds 99.6°F, shorten the work cycle by one third. Workers shall not wear semipermeable or impermeable garments when their oral temperature exceeds 100.6°F.
- Body Weight - Using a standard scale, workers are weighed prior to beginning work, at breaks, and at the end of shift. If body weight is decreased by 1.5 percent or more, rehydration must be accomplished before the worker may return to work. Rehydration may be accomplished minimally by the worker consuming 80 percent of the volume of fluids lost to perspiration (i.e., 12 ounces of fluids for each pound lost to sweating). Workers must be completely rehydrated before beginning each work day.
- Symptoms of Heat Stress - Heat rash; heat cramps; muscle spasms; pain in hands, feet, and abdomen; pale, cool, and moist skin; hot dry skin; heavy sweating or noticeable lack of sweating; dizziness; nausea; fainting; and confusion.

Project personnel will be instructed in the detection of signs and symptoms and the preventive measures to avoid heat stress-related illnesses. Personnel exhibiting any symptoms of heat stress will be removed from the work area to a cool place. Personnel suffering from heat stroke will be transported to a medical facility for evaluation. No worker who has experienced heat stroke may return to work without authorization from a physician.

3.4.1.3 Sunburn

Sunburn occurs when the skin is exposed to the ultraviolet radiation from the sun. Sunburn can occur on cloudy days as well as sunny ones. Clothing which covers the skin will reduce the potential exposure to the radiation of the sun. Light-colored clothing will reflect sunlight better than bare skin. Hats may be used to shade the face. Use a sunscreen to protect exposed skin from the radiation of the sun.

3.4.1.4 Prevention of Heat Stress

Heat stress can be prevented if proper administrative and engineering controls are used. It is important to prevent heat stress in workers. Workers who are subject to heat stress are prone to develop other heat-related illnesses. Workers who are overweight, in poor physical condition, or not used to hot environments are more likely to experience heat stress.

On outdoor sites, engineering controls are limited to air conditioning in the cabs of construction vehicles and the provision of a cool rest area. Administrative controls become particularly important under these circumstances. Modification of work and rest periods is the principal means for controlling heat stress at outdoor sites. Drinking water will be provided for workers. The water will be kept between 50°F and 60°F. Electrolyte supplement beverages may also be provided, but not to the exclusion of drinking water.

Operations at the Fansteel site are scheduled for the spring months in a temperate climate. It is anticipated that exposure to high ambient temperatures and relative humidity will occur. Site operations may be conducted during the morning hours to reduce the potential exposure to high ambient temperatures and excessive humidity. The Health and Safety Officer will monitor site conditions and personnel to reduce the risk of heat stress caused by the use of PPE, high humidity, or high ambient temperatures. Workers who develop heat stroke will require authorization from a physician to return to work.

3.4.2 Cold Stress

Project personnel may be subjected to cold stress if the temperature is below freezing. When there are high winds even on moderately cold days, frostbite and hypothermia may occur. Exposed skin such as fingers and face are especially vulnerable to frostbite. Wet clothing can lower the body temperature due to the evaporative heat loss effect as the water from the clothing evaporates. Wet shoes, socks, or standing in water can cause trench foot in moderate temperatures and freezing of tissues in colder temperatures. Breaks are particularly important when ambient air temperatures are below 10°F or wind chill factors and lake effects lower apparent temperatures below -25°F. Personnel exhibiting signs of cold stress will be removed to a warm area. First-aid treatment or medical attention will be provided as needed.

Operations at the Fansteel site are scheduled for the spring months in temperate climates. It is not anticipated that exposure to extremely low ambient temperatures will occur. Personnel will not be dispatched to sites in extremes of temperature. The Health and Safety Manager may suspend operations if ambient conditions are excessively cold.

The Health and Safety Officer will monitor site conditions and personnel to reduce the risk of hypothermia caused by sudden evaporative heat loss, wind chill, or low ambient temperatures. Proper clothing will be worn to protect workers during cold weather. Workers who develop hypothermia will require authorization from a physician to return to work.

Table 3-3
Work/Warm-Up Schedule Guidelines for a 4-Hour Shift

Ambient Air Temperature (°F)	Wind Speed (miles per hour)				
	0	5	10	15	20
	Work Period (minutes)/Number of Breaks				
-15 to -19	Normal/1	Normal/1	75/2	55/3	40/4
-20 to -24	Normal/1	75/2	55/3	40/4	30/5
-25 to -29	75/2	55/3	40/4	30/5	*
-30 to -34	55/3	40/4	30/5	*	*
-35 to -39	40/4	30/5	*	*	*
-40 to -44	30/5	*	*	*	*
less than -45	*	*	*	*	*

* Operations should cease under these conditions. Emergency operations may be conducted using extremely short work periods or special equipment and clothing.

3.5 Indigenous Flora and Fauna

Personnel may be working in areas where wild animal and plant populations exist. Contact with poisonous plants, snakes, and small rodents may be of particular concern. Contact with unfamiliar plants and animals should be avoided. Attention paid to the surroundings will help reduce injury.

3.5.1 Animals

Personnel may be working in areas where wildlife populations exist. Contact with snakes and small rodents may be of particular concern. Contact with these animals should be avoided. Remember that they are probably as afraid of people as people are afraid of them.

Avoid contact with the indigenous wildlife. Squirrels, raccoons, and skunks may bite or spray, especially if they are frightened or their young are threatened. Do not attempt to injure or kill the animal. An injured

animal is more likely to attack. Injured animals are dangerous. Animals that behave strangely or are not afraid of people may be rabid or sick. Get medical attention for any animal bite.

Areas with high grass may harbor snakes. Stream beds and riverbanks are favored by some types of snakes. Boots which cover the ankle will reduce the potential for a snake to bite an ankle. Snake bites should be treated by lowering the bitten part and securing medical assistance. It is currently not considered desirable to attempt to remove the venom by cutting or suction. Keep the bitten person calm and restrict movement as much as possible.

3.5.2 Insects

Insect bites are usually not harmful, but may be painful. Avoid bites by using insect repellent. Treat mosquito bites and nonpoisonous spider bites with anti-itch preparations. Ticks may carry Lyme disease. Have tick bites treated by a physician.

3.5.3 Plants

Poison ivy, oak, and sumac may be present at the site. If contact occurs with poison ivy, oak, or sumac, thoroughly wash the area with soap and water. This will prevent the rash if the plant oil is removed quickly. If a rash develops, treat it with a drying agent for poison ivy. If the rash is extensive, seek medical help. Avoid contact with plant species that are not familiar. Do not eat plants found in the wild.

3.6 Rough Terrain

Rough and unfamiliar terrain can lead to injury. Slips, trips, and falls are the most common accidents caused by changes in the terrain. These accidents may result in cuts, bruises, and sprains. Falls may result in broken bones. Persons slipping on the banks of creeks or rivers have fallen into the water and drown.

Carefully examine unfamiliar terrain. Look for holes, undergrowth, and open water. Avoid walking in areas where the undergrowth is heavy. In addition to the hazards of tripping, undergrowth provides harborage for small animals and snakes. Branches, thorns, and brambles may cut the skin. Avoid the banks of creeks, rivers, and ponds.

Wear boots with good ankle support, sole strength sufficient to resist punctures, and good traction. Wear long pants, long-sleeved shirts, and socks in the field. Short-sleeved shirts may be permitted at some sites. Do not wear short pants, tube tops, muscle shirts, or sandals. Bare feet and chests are prohibited at the Fansteel site.

3.7 Musculoskeletal Injuries

Sprains and strains will be prevented by restricting the weight lifted by groundwater monitoring personnel. Wells will be pumped rather than bailed whenever possible. Light-weight plastic bailers will be used when possible. Extreme care is required when stainless steel bailers are used, since they are heavy even before they are filled. Large-diameter bailers may also be excessively heavy when full.

Personnel who routinely bail wells will become conditioned to the physical labor involved. Those new to this operation should be aware that the repetitive nature of the operation can lead to strains and sprains, and take appropriate precautions. Limit the number of wells bailed. Limit the length of the bailer. Avoid having the bailer so long that an overhead lift is required to remove it from the well.

4.0 Training

Project personnel participating in on-site activities at the Fansteel site will have received safety training as prescribed by OSHA under 29 CFR 1910.120. This will generally include the 40-hour health and safety training course for hazardous materials and waste operations and refresher courses as appropriate. Supervisory personnel will have also received the additional training as required by these regulations.

Subcontractors used by Earth Sciences must provide the Site Health and Safety Officer with appropriate documentation of the health and safety training provided to their personnel. The Site Health and Safety Officer may refuse entry to subcontractor personnel who cannot supply the necessary documentation of training. The Health and Safety Manager and/or the Site Health and Safety Officer will determine the adequacy of the training provided by contractors and/or subcontractors to their personnel.

Safety training and briefings will be conducted before any work begins at the site. This training will include the specifics of the tasks to be performed, the hazards associated with the performance of those tasks, and the PPE required for the tasks. General and specific hazards associated with the site will be addressed.

Prior to undertaking specific tasks which may require unusual or specific training, the personnel involved in those tasks will receive instruction in the appropriate areas. Specifically included among such tasks is the operation of mobile-powered equipment and construction vehicles. Operations requiring specific training under OSHA such as confined space entry, cutting, welding, working in proximity to energized electrical equipment, or similar operations are not anticipated at the site. Should such operations become necessary, additional training will be provided to project personnel engaged in these operations.

Records of health and safety training for personnel employed by Earth Sciences will be maintained in Earth Sciences' corporate offices. When more than one person is required for site operations, periodic safety meetings will be conducted on the site to discuss upcoming activities and the specific hazards involved with them. These meetings will be documented as to attendants, presenter, subjects presented, and the date.

5.0 PPE

PPE requirements for this project will be sufficient to protect personnel at the Fansteel site from hazards known or believed to be present and for which engineering controls are not practical. For most site operations, Level D protection is anticipated. Level D protection will consist of a basic complement of work clothing. Dermal protection will be added as required by the job. For the purposes of this health and safety plan, Level C protection will require the use of either full- or half-face air-purifying respirators.

The PPE specified in this health and safety plan consists of dermal protection against mechanical injury, exposure to residual chemical materials that may be found on site, and exposure to potentially hazardous chemicals used in cleaning and/or decontamination activities. Respiratory protection equipment will be provided when needed as protection against airborne chemical contaminants and dusts.

5.1 Dermal Protection Equipment

Dermal protection will consist of coated or uncoated Tyvek (or other material of similar properties) garments, impermeable boots, and impermeable gloves. Protective equipment supplying mechanical protection against cuts, abrasions, or other physical damage to the hands, feet, and extremities may be required for some tasks. Dermal protection will be utilized under the direction of the Health and Safety Officer. Additional dermal protection may be requested by and utilized at the option of any worker on the site. Protective clothing such as chemical-resistant splash suits or additional layers or types of gloves or boots may be required by the Site Health and Safety Officer should site conditions warrant. The Health and Safety Officer in conjunction with the Health and Safety Manager will evaluate individual tasks and work areas for the purpose of determining the appropriate PPE. Particular types of PPE may be specified for employees performing specific tasks or working in particular areas based on this evaluation. Task-specific PPE requirements are prescribed in Section 3.3.

5.1.1 Eye and Face Protection

The face and eyes of site personnel will be protected against flying objects, splash, spray, potentially harmful vapors, and glare. All site personnel will wear approved safety glasses which comply with ANSI Standard Z87 in accordance with 29 CFR 1910.133/29 CFR 1926.102 as the minimum level of protection during site activities. Goggles and/or face shields may be required by the Site Health and Safety Officer whenever splash hazards are present. In the event that irritating vapors or dusts are encountered, full-face respirators may be required to protect the face and eyes.

5.1.2 Head Protection

Head protection as required by OSHA will be utilized by all site personnel as well as visitors who enter work areas. During work with or in the vicinity of mobile-powered equipment, hard hats are required to minimize the risk of head injury. Hard hats are also required where the danger of falling objects or bump hazards exists. Hard hats will comply with ANSI Standard Z89.1 as specified in 29 CFR 1910.135/29 CFR 1926.100.

5.1.3 Hand Protection

Hand protection is a concern for site workers with regard to the potential for contact with dermal active chemicals; temperature extremes; and protection from mechanical damage such as cuts, abrasions, and blisters. Organic solvents or other materials present on the site may cause skin injury, irritation, or absorption. Hand protection is also a concern for potentially hazardous mechanical operations where the risk of injury may be compounded by chemical hazards. Protection against abrasion and cuts will be provided by mechanically-resistant materials. Gloves will be selected using industry criteria, recommendations of the manufacturer, and the regulations specified in 29 CFR 1910.138.

General-purpose cloth or leather work gloves will be provided for workers. Gloves with insulating or reflective materials will be used, if needed, to add protection against extremes of temperature. Protection against chemicals and chemical residues will be provided by chemical-resistant gloves. Gloves constructed of appropriate materials for the anticipated contaminants will be available at the work site. Nitrile gloves worn over latex gloves are anticipated to be adequate for the tasks being performed which involve exposure to organic solvents, oils, and dusts. Different or additional types of gloves may be required if glove degradation occurs. If gloves become brittle, tacky, cracked, or exhibit other signs of degradation, they must be removed immediately. Hands must be washed and new gloves donned before returning to work.

5.1.4 Foot Protection

Personnel will wear hard-toe boots for mechanical protection against potential hazards to feet or toes. These boots will comply with ANSI Standard Z41 as specified in OSHA regulation 29 CFR 1910.136/29 CFR 1926.96. Chemical protection or protection from water may be required. Chemical-resistant boots or overboots will be utilized when site conditions warrant or when decontamination will be required. The Health and Safety Officer will select the appropriate foot protection for operations involving potential exposure to chemicals or chemical residues. Rubber overboots are anticipated to provide adequate protection from water, decontamination chemicals, and contaminated soils.

5.2 Respiratory Protection

Respiratory protection specified under this health and safety plan for work in open areas is for the reduction of organic vapors, dusts, and mists in the breathing air. The presence of benzene in excess of 1 part per million will require the use of respiratory protection. NIOSH-approved half-face or full-face air-purifying respirators as specified in 29 CFR 1910.134 and NIOSH-approved HEPA filter cartridges are provided to project personnel under this plan for dusts. The presence of unspecified organic vapors will require the use of NIOSH-approved organic vapor cartridges. Combination organic vapor cartridges with HEPA filters may be used if oil mists or aerosols are present. Whenever airborne hazardous dusts, fumes, gases, or vapors are known or believed to be present in a work area, the Health and Safety Officer will specify the use of appropriate respiratory protection. Table 5-1 presents the guidelines for the selection and use of respiratory protection at the Fansteel site.

Respiratory protection devices of equivalent type may be used by subcontractor personnel. The Site Health and Safety Officer must specifically approve alternative types of respirators and cartridges prior to their use at the site. The use of air-purifying respirators (Level C) or supplied-air respiratory protective devices (Level B) is not anticipated. Should conditions develop on the site where supplied air would be necessary, the area of concern will be evacuated. Access to oxygen-deficient areas of the site will be restricted or denied until the conditions are safe or supplied-air respirators are available. A site-specific health and safety plan will be required for Level B operations.

Site personnel who may utilize respiratory protection devices will be trained in their use and must have received a medical examination to determine their ability to wear a respirator before starting work. Each person who uses a respirator must have been fit tested within the previous year in the size and type of respirator actually in use. Documentation of the fit testing and training provided by subcontractors must be presented to the Site Health and Safety Officer before work commences.

5.3 Other Protective Equipment

At the discretion of the Site Health and Safety Officer, additional types of PPE may be required based on actual working conditions. Selection, documentation, and approval of such PPE will be made by the Site Health and Safety Officer.

Table 5-1
Respiratory Protection Equipment
Use and Selection Criteria

Contaminant	Action Level	Required PPE or Action
Organic Vapor ⁽¹⁾	Breathing zone concentrations in excess of 5 ppm sustained for at least 30 seconds.	Half-face or full-face air-purifying respirator/organic vapor cartridges. ⁽²⁾
	In excess of 25 ppm in breathing zone, or respirator breakthrough.	Evacuate and ventilate work area. Retest atmosphere.
Benzene ⁽³⁾	Breathing zone concentrations in excess of 1 ppm.	Half-face or full-face air-purifying respirator/organic vapor cartridges. ⁽²⁾
	In excess of 10 ppm in the breathing zone or respirator breakthrough.	Evacuate and ventilate work area. Retest atmosphere.
Methylene Chloride ⁽³⁾	Breathing zone concentrations in excess of 25 ppm.	Evacuate and ventilate work area. Retest atmosphere.
Vinyl chloride ⁽³⁾	Breathing zone concentrations in excess of 1 ppm.	Evacuate and ventilate work area. Retest atmosphere.
Dusts, Fumes, or Mists ⁽⁴⁾	Particulate matter in the breathing zone in excess of 0.75 milligram per cubic meter or visible dust in the air.	Application of appropriate engineering control measures. Half-face or full-face air-purifying respirator/HEPA cartridges if levels cannot be reduced by engineering controls.
Combustible Gases ⁽⁵⁾	Concentration in excess of 10 percent of the lower explosive limit.	Evacuate and ventilate work area. Retest atmosphere.
Oxygen ⁽⁵⁾	Less than 19.5 percent.	Evacuate and ventilate work area. Retest atmosphere. If oxygen concentration remains below 19.5 percent, positive-pressure supplied-air respirators will be required.

⁽¹⁾ As measured using the MSA Photon, H-Nu Systems PI-101, or other comparable instruments.

⁽²⁾ Combination type with HEPA/P-100 prefilter recommended.

⁽³⁾ As measured using appropriate colorimetric detector tubes.

⁽⁴⁾ As measured using appropriate dust monitor.

⁽⁵⁾ As measured using appropriate combustible gas and oxygen meter.

5.4 PPE Ensembles

Personnel wear combinations of PPE. Laboratory workers wear rubber gloves, goggles, and lab coats. Construction workers wear hard hats, leather gloves, safety glasses, and steel-toe boots. The combinations selected are based on the job hazards, the hazardous materials, comfort, and cost.

Four levels of protection were established by the U.S. Environmental Protection Agency (USEPA) under the Resource Conservation and Recovery Act for operations involving hazardous wastes. These levels have been incorporated into Appendix B of 29 CFR 1910.120. The levels of protection are described below as they are defined in 1910.120 and the USEPA documents. When selecting a level of protection, choose the lowest level which provides adequate protection for the hazards involved.

5.4.1 Level A

Level A protection is selected when the greatest level of skin, respiratory, and eye protection is required. Level A equipment includes the following:

- NIOSH-approved positive-pressure, full-face piece, self-contained breathing apparatus (SCBA), or positive-pressure air line respirator with escape SCBA.
- Totally encapsulating chemical-protective suit
- Coveralls*
- Long underwear*
- Chemical-resistant outer gloves
- Chemical-resistant inner gloves
- Chemical-resistant steel-toe and shank boots
- Hard hat (under suit)*
- Disposable protective suit, gloves, and boot covers (may be worn over totally encapsulating suit)*
- Two-way radios (worn inside encapsulating suit)

*Optional, as applicable.

Level A protection should be used when:

- The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system.
- Substances with a high degree of hazard to the skin or those which are capable of being absorbed through intact skin are known or suspected to be present.
- The atmosphere contains less than 19.5 percent oxygen.
- Operations must be conducted in confined poorly ventilated areas where the absence of conditions requiring Level A has not yet been determined.

5.4.2 Level B

Level B is selected when the highest level of respiratory protection is necessary but a lesser level of skin protection is required. Level B equipment includes the following:

- NIOSH-approved SCBA or positive-pressure air line respirator with escape SCBA
- Hooded chemical-resistant clothing (coveralls; one- or two-piece chemical splash suit; disposable chemical-resistant coveralls)
- Coveralls*
- Chemical-resistant outer gloves
- Chemical-resistant inner gloves
- Steel-toe boots
- Chemical-resistant disposable boot covers
- Hard hat
- Two-way radios
- Face shield*
- Safety glasses or goggles

*Optional, as applicable.

Level B protection should be used when:

- The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection but less skin protection. This involves atmospheres with IDLH concentrations of specific substances that do not present a severe skin hazard.
- The presence of airborne materials which do not meet the criteria for air-purifying respirators.
- The atmosphere contains less than 19.5 percent oxygen.
- Direct-reading instruments or organic vapor monitors detect the presence of high levels of incompletely identified gases or vapors that are not suspected to be harmful to or absorbed by the skin.
- When entering an uncontrolled hazardous waste site where airborne contaminant concentrations are unknown. This is a minimum requirement under OSHA regulations.

5.4.3 Level C

Level C is selected when the concentrations and types of airborne contaminants are known and the criteria for use of air-purifying respirators are met. Level C equipment includes the following:

- NIOSH-approved full-face or half-mask air-purifying cartridge or canister-equipped respirators

- Chemical-resistant clothing
- Coveralls*
- Chemical-resistant outer gloves
- Chemical-resistant inner gloves
- Safety shoes or boots
- Chemical-resistant disposable boot covers*
- Safety glasses with side shields (or chemical splash goggles*)
- Hard hat
- Escape respirator*
- Two-way radios
- Face shield*

*Optional, as applicable.

Level C protection should be used when:

- The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin.
- The types and concentrations of air contaminants have been identified and air-purifying respirator elements are available which are capable of removing the contaminants.
- Criteria for the use of air-purifying respirators are met.

5.4.4 Level D

Level D is primarily a work uniform affording minimal protection. It should be worn only in areas where there is no possibility of contact with contamination. Level D equipment includes the following:

- Coveralls
- Gloves*
- Safety shoes or boots
- Chemical-resistant disposable outer boots*
- Hard hat
- Escape respirator*
- Face shield*
- Safety glasses or goggles

*Optional, as applicable.

The minimum level of protection to be worn at field sites consists of the following:

- Work clothes
- Safety shoes with hard toes and sufficient sole strength to resist punctures
- Safety glasses with side shields

Level D protection should be used when:

- The atmosphere contains no known hazard.
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

5.4.5 Modifications

Modified levels of protection are used to accommodate the specifics of the job. Modified levels generally include upgrades which would not be required by the next level. Level D does not include respiratory protection or chemical-resistant clothing. Level C includes air-purifying respirators. Modified Level D adds dermal protection to Level D, but not additional respiratory protection. If air-purifying respirators are required, then the upgrade is to Level C. Regardless of the dermal protection required, if air-purifying respirators are used, the ensemble is Level C. Level B requires supplied-air respirators. Any upgrade which requires these respirators is Level B. Level A adds extra dermal protection to Level B.

6.0 Medical Surveillance

No project-specific medical surveillance plan is proposed for the Fansteel site covered by this plan. All project personnel who are engaged in field activities are covered under the general medical surveillance guidelines presented in Section 6.1 below.

6.1 General Medical Surveillance

All project personnel who are engaged in field activities are required to have a physical examination prior to initial field assignments. This includes a pulmonary function test and an examination by a qualified licensed physician to determine the physical ability of the person to work while wearing respiratory protection and other required PPE. Annual physicals are provided to field personnel as required under 29 CFR 1910.120 and 29 CFR 1910.134.

6.2 Medical Symptoms or Exposures

Any employee who believes that he has been overexposed to chemical or physical agents or who develops symptoms that could reasonably indicate an overexposure must report the exposure to his supervisor. An appropriate medical consultation will be arranged by the Health and Safety Manager and the Human Resources Department. Follow-up examinations or referrals to specialists will be provided should the examining physician so recommend.

6.3 Medical Records

Medical records are maintained by the attending physician. A medical statement of fitness to work is maintained in the Human Resources Department. A copy of the fitness for duty statement may be maintained at the site if required by regulations. Copies of employee medical records may be obtained by submitting a written request to the attending physician or to the Human Resources Department in accordance with the Health and Safety Policy Manual.

7.0 Environmental Monitoring

Environmental monitoring is anticipated to be required at the Fansteel site covered by this plan. The site has been partially characterized and presents low levels of risk. Levels of airborne contamination are not expected to present health risks for site personnel or a risk of fire or explosion. Activities which have the potential to increase the levels of contamination in a work area are considered under this health and safety plan.

The program for environmental monitoring covers the site activities mentioned in Chapter 1.0 of this document for the Fansteel site. Prior to initial site entry and at regular intervals, the Health and Safety Officer will visually check each work area and the surrounding soils, etc., for indications of the presence of potentially hazardous materials.

Ambient air monitoring will be conducted prior to initial site entry and as needed during the course of site work. Appropriate instrumentation will be utilized as required by the Health and Safety Officer. Such instruments may include colorimetric detector tubes, organic vapor detectors, oxygen detectors, dust monitors, pH meters, or other devices. The Health and Safety Officer may require additional environmental or personal monitoring based on his observations of conditions at the site work areas. Work area environmental monitoring results will be recorded and maintained as part of the project documentation.

7.1 Organic Vapors

Analysis for organic vapors will be conducted prior to initial site entry and during operations presenting the potential for the production of organic vapors. Such operations would include well bailing where free product has been encountered, sample collection and compositing where free product is present, and decontamination activities using organic solvents. Analysis of soils and waters being brought to the surface for organic vapors may be included as part of the sampling and analysis program as well as the health and safety plan.

Flame ionization detector instrumentation may be used for this task. If the air in the breathing zone shows organic vapors in excess of 1 part per million over a period of 30 seconds or more, air monitoring specific for benzene and vinyl chloride will be performed. If either level exceeds 1 part per million, respiratory protection will be required. If benzene and vinyl chloride levels are less than 0.2 part per million, work may continue without additional respiratory protection until the concentration of organic vapors exceeds 5 parts per million in the breathing zone sustained for 30 seconds or more. Respiratory protection will be required for organic vapor levels exceeding 5 parts per million. Evacuation of the area will be required if the organic

vapor levels exceed 25 parts per million or benzene or vinyl chloride levels exceed 10 parts per million. An evaluation of the work area by the Site Health and Safety Officer will be performed. Ventilation of the area may be necessary to reduce organic vapor concentrations. If organic vapor levels of less than 1 part per million benzene and vinyl chloride and 5 parts per million organic vapors are not achieved, respiratory protection will be required if operations are to be continued. Respiratory protection will be utilized as dictated by need and on-site monitoring and in accordance with the guidelines set forth in Chapter 5.0, PPE.

7.2 Particulates

Dust monitoring at soil sampling and monitoring well installation sites may be required if dry weather conditions prevail and engineering controls are not available or advisable. Dust levels may be monitored using real-time detectors such as the Mini-RAM Personal Dust Monitor or standard industrial hygiene or environmental methods. The soils present at these sites are not anticipated to be significantly disturbed by site activities. Engineering controls such as misting will be initiated should dust be visible in the air. Measures to control dust from staged soils will include covering and misting as necessary. If dust levels are not controlled by these methods, respiratory protection as specified in Chapter 5.0, PPE will be required.

7.3 Specific Gases

Benzene and vinyl chloride monitoring will be conducted using specific colorimetric detector tubes. When total organic vapor concentrations exceed 1 part per million, specific testing for benzene and vinyl chloride will be conducted. Respiratory protection will be required as specified in Chapter 5.0, PPE if benzene levels cannot be maintained below 1 part per million. Vinyl chloride levels in excess of 1 part per million will require evacuation of the area until the levels are less than 1 part per million. If this cannot be accomplished, Level B respiratory protection will be required and revisions to this plan will be required.

7.4 Oxygen

Enclosed work areas or areas where airflow may be restricted will be surveyed for the presence of oxygen deficiency prior to initial entry. Work areas will be monitored for oxygen deficiency during the course of work when conditions or operations produce the potential for oxygen deficiency. Oxygen levels less than 19.5 percent are not anticipated to occur during site operations conducted in open air situations. Continuous monitoring instrumentation with preset alarms such as the Mine Safety Appliances Company Model 360 will be operating during high hazard operations. In the event that the alarm on the instrument sounds, personnel will evacuate to a safe place. The site area may not be reentered until monitoring indicates that the area is no longer a danger.

7.5 Calibration

All instrumentation used will be calibrated and maintained in accordance with applicable regulations and the requirements and instructions provided by the manufacturer. Organic vapor monitors require daily calibration checks. Combustible gas indicators and oxygen detectors will have daily calibration checks performed. Air monitoring instrumentation which requires specific flow rates will have flow checks performed before and after sampling events. When calibrations are recommended by the manufacturer at different intervals from those described, the Health and Safety Manager will specify the calibration frequency. Instruments must be calibrated after major repairs and maintenance. Instrument maintenance and calibration activities will be recorded and maintained as part of the health and safety daily log. These logs will be maintained at the site during site operations and will become part of the project permanent record.

8.0 Site Control

The Fansteel site is not an operating facility. The site perimeters are controlled by fencing and gates. Access is restricted to authorized personnel. Site personnel may be on the site with employees of the facility, other workers, or alone.

Site operations addressed by this health and safety plan may occur in areas where other activities are being conducted. These activities may occur in isolated locations where there are no other operations occurring. The activities addressed by this plan conducted by Earth Sciences and the contractors and subcontractors may occur concurrently.

Establishing of permanent site zones is not anticipated. Temporary operation zones are not anticipated to be established as part of the site activities. Areas where sampling and installation-related activities are occurring may require restriction of access. No person may enter a designated work area without the complement of PPE specified by the Health and Safety Officer for that area. PPE selections are based on the work to be performed and the hazards present as specified in Chapter 5.0, PPE and Section 3.3.

Restricted areas designated by the Health and Safety Officer will be clearly marked in the field. The restrictions and requirements will be posted and/or verbally communicated to persons on the site. Temporary exclusion zones (EZ) and contamination reduction zones (CRZ) will be established for work areas that present a significant risk of exposure to hazards including, but not limited to, the presence of free product, asbestos, open excavations, or dust-generating operations. EZ may also be established around areas of significant contamination to prevent the spread of contaminated materials. Decontamination procedures will be required for persons or equipment leaving the EZ.

The EZ and CRZ will be delineated by appropriate physical barriers. Fencing or similar barriers will be constructed around permanent zones. These areas will be equipped with appropriate signage. Temporary EZ and CRZ will be marked in the field using flagging tape or temporary construction fencing with appropriate signage. Temporary EZ or CRZ barriers will remain in place until the work in the zone is completed or until the potentially hazardous conditions that caused an area to be designated as an EZ are eliminated. The decision to establish or eliminate an EZ or to modify required PPE, environmental monitoring, or other operational requirements will be made by the Health and Safety Officer.

Support zones (SZ) will consist of the areas of the site which are not contaminated and are not being used for the CRZ. Every effort will be made to prevent the contamination of clean areas and the SZ. Personnel and equipment entering the SZ after having been in the EZ or CRZ must be decontaminated.

9.0 Decontamination

Decontamination of personnel and equipment at the Fansteel site will be conducted to reduce the risk of off-site migration of contaminants. Decontamination of equipment may be performed between tasks to reduce the potential for cross contamination. Personnel decontamination will be conducted when workers leave contaminated work areas and enter clean areas. Decontamination activities will be performed carefully to avoid contamination of workers and the environment. The procedures outlined in the sections below will be utilized during decontamination activities.

9.1 Personnel Decontamination

Personnel conducting soil sampling and groundwater monitoring well installation and sampling activities will require minimal decontamination. Disposable PPE should be removed and placed in appropriate containers for transport and disposal. Gloves should be removed carefully to prevent contamination of the hands. If free product has been encountered or site-specific contaminants have been encountered, PPE may be required to be disposed at the site. Consult the Health and Safety Manager if there are questions concerning this requirement for a specific site.

Personnel who have entered an EZ or who have been otherwise exposed to the contaminants at soil sampling and groundwater monitoring well installation and sampling sites will require decontamination. Personnel must pass through the decontamination facility whenever they enter clean areas and prior to leaving the site. The decontamination facility may consist of an on-site trailer, cleanup area, or a field decontamination station. When operations are occurring in several areas, personnel may be required to pass through more than one decontamination station. Decontamination stations may be of various types, depending on the contaminants of concern and the operations being performed. In the event of a life-threatening emergency, decontamination may be suspended by the Site Health and Safety Officer.

Personnel will enter the decontamination facility from the EZ through the inner or contaminated side of the CRZ. All contaminated materials must be left in the CRZ. Contaminated wash water or other decontamination materials must remain in this area until it is removed for proper disposal. All wash water, decontamination solutions, and residues will be collected in appropriate containers for management and/or disposal. Contaminated materials and decontamination fluids will be disposed in accordance with applicable federal, state, and local regulations

Decontamination of personnel contaminated with site materials is anticipated to consist of washing affected areas with a soap and water solution. Skin surfaces will require rinsing with clean water. In the event that

water is not available for decontamination of personnel, waterless cleaners may be used. Personnel should not use decontamination chemicals such as hexane or methanol on their skin, as these facilitate the passage of chemicals across intact skin. Materials which have come into contact with used waterless cleaners such as towels must be handled as if they were contaminated until it is proven by laboratory analysis that they are not.

9.1.1 Disposable PPE

Disposable PPE will be removed and placed in designated receptacles. Suits and gloves should be removed carefully to reduce contamination of personnel and the area. Remove suits and gloves by folding the soiled sides together so that the worker touches the clean side of the garment after removal. If assistance is required to perform these activities, decontamination personnel will be present in the CRZ. Decontamination personnel will wear appropriate PPE for the task; generally, this is one level below that required in the EZ.

In the event that disposable PPE is heavily soiled or contaminated, preliminary decontamination procedures may be implemented. Such PPE may require preliminary washing with detergent solutions, or special removal techniques. The number, type, and arrangements of preliminary decontamination steps will be determined on a case-by-case basis by the Health and Safety Manager and/or Site Health and Safety Officer.

9.1.2 Reusable PPE

Reusable PPE will be placed in a designated location for cleaning and decontamination prior to reuse. Respirators and boots are anticipated to be among the reusable PPE items.

9.1.2.1 Boots

Most workers will wear leather hard-toe boots with or without rubber overboots for site operations. The soles of boots will be cleaned prior to personnel leaving a contaminated area. Equipment will be provided to remove gross contamination from boots, such as brushes, mats, or boot scrapers. Boot wash stations equipped with brushes, wash solutions, and rinse water will be established at the perimeter of the contaminated areas.

9.1.2.2 Respirators

Respirator cleaning is the responsibility of the person who is issued the respirator. Cleaning of respirators will be accomplished in accordance with the instructions provided by the manufacturer of that respirator. Respirator cartridges will be removed from the respirator prior to cleaning. Single use respirators will be

treated as disposable PPE. Respirator wipe pads may be used to freshen the respirator surfaces during the workday, but thorough cleaning is required on a daily basis.

For general cleaning, respirators will be washed in a cleaner/sanitizer solution to remove soil and perspiration accumulated during the work day. Never use alcohol on respirator parts. A soft brush may be used to remove dirt if necessary. The respirator will then be rinsed in clean water and allowed to air dry. Clean toweling or soft cloths may be used to dry the areas of the respirator which do not drain well. Clean dry respirators are to be stored in sealed plastic bags away from heat and direct sunlight.

9.1.2.3 Multiple Use Items

Multiple use items which cannot be easily decontaminated, such as leather work gloves, will be placed in plastic bags and stored in the CRZ for future use. Such items may not leave the site and will be disposed when their useful life is over or the project is completed, whichever comes first. Heavily contaminated work clothing will be left in the CRZ in designated containers. These items will be disposed, laundered, or processed for laundering in a controlled area or the CRZ to prevent the spread of contamination into clean areas. If laundering is done by an outside concern, the laundry will be notified of the potential contamination of the materials so that appropriate precautions may be observed.

9.2 Equipment Cleaning

On-site equipment which is potentially affected by chemical residues will be taken to a predetermined cleaning area. A high-pressure washing device may be used in conjunction with conventional detergent solutions to clean contaminated equipment. Equipment contaminated with metal residues may require acid washing. Equipment contaminated with oils or organic solvents may require acetone, hexane, and/or methanol washes. Detergent and acid residues will be removed using clean water. Distilled water will be used for rinsing when equipment is to be used for sampling. All wash water, solutions, and decontamination residues will be collected in appropriate containers for management and/or disposal.

If equipment or tools must be cleaned at a location other than the designated decontamination facility, they will be carefully wrapped in plastic and sealed after cleaning. The wrapped tools or equipment will then be transported to the decontamination area. The equipment will then be unwrapped and additional cleaning will be done. The equipment may then be removed from the site or stored in the clean areas of the site for future use.

Disposable equipment or equipment which cannot be cleaned will require disposal as contaminated materials. Laboratory analysis of these materials may be required to determine if they meet the definition of hazardous materials or wastes. These items will be placed in designated containers for processing. Contaminated materials and decontamination fluids will be disposed in accordance with applicable federal, state, and local regulations.

9.3 Decontamination Schemes

General criteria for decontamination schemes required for various levels of protection as defined by the USEPA and OSHA are described in the following section. Variations may be necessary depending on the contaminants encountered. Equipment requirements are approximate. Additional equipment may be required, especially if more than one decontamination scheme or station is required.

Equipment Needed to Perform Maximum Decontamination Measures for Levels A, B, and C

Station 1:	<ul style="list-style-type: none"> a Various Size Containers b Plastic Liners c Plastic Drop Cloths 	Station 10	<ul style="list-style-type: none"> a Containers (20 to 30 gallons) b Plastic Liners c Bench or Stools d Boot Jack
Station 2	<ul style="list-style-type: none"> a. Containers (20 to 30 gallons) b Decontamination Solution or Detergent Water c. 2 to 3 Long-Handled, Soft-Bristled Scrub Brushes 	Station 11	<ul style="list-style-type: none"> a. Rack b Drop Cloths c. Bench or Stools
Station 3	<ul style="list-style-type: none"> a. Containers (20 to 30 gallons) Or High-Pressure Spray Unit b Water c 2 to 3 Long-Handled, Soft-Bristled Scrub Brushes 	Station 12	<ul style="list-style-type: none"> a Table
Station 4	<ul style="list-style-type: none"> a Containers (20 to 30 gallons) b Plastic Liners 	Station 13	<ul style="list-style-type: none"> a Basin or Bucket b Decontamination Solution c Small Table
Station 5	<ul style="list-style-type: none"> a. Containers (20 to 30 gallons) b Plastic Liners c Bench or Stools 	Station 14	<ul style="list-style-type: none"> a Water b Basin or Bucket c. Small Table
Station 6:	<ul style="list-style-type: none"> a. Containers (20 to 30 gallons) b Plastic Liners 	Station 15	<ul style="list-style-type: none"> a Containers (20 to 30 gallons) b Plastic Liners
Station 7	<ul style="list-style-type: none"> a Containers (20 to 30 gallons) b Decontamination Solution or Detergent Water c 2 to 3 Long-Handled, Soft-Bristled Scrub Brushes 	Station 16	<ul style="list-style-type: none"> a Containers (20 to 30 gallons) b Plastic Liners
Station 8.	<ul style="list-style-type: none"> a. Containers (20 to 30 gallons) Or High-Pressure Spray Unit b. Water c 2 to 3 Long-Handled, Soft-Bristled Scrub Brushes 	Station 17.	<ul style="list-style-type: none"> a Containers (20 to 30 gallons) b Plastic Liners
Station 9	<ul style="list-style-type: none"> a Air Tanks or Face Masks and Cartridge Depending on Level b Tape c Boot Covers d Gloves 	Station 18	<ul style="list-style-type: none"> a Water b Soap c Small Table d Basin or Bucket e Field Showers f. Towels
		Station 19	<ul style="list-style-type: none"> a Dressing Trailer is Needed in Inclement Weather b. Tables c Chairs d. Lockers e Cloths

Equipment Needed to Perform Minimum Decontamination Measures for Levels A, B, and C

Station 1:	a Various Size Containers b Plastic Liners c Plastic Drop Cloths	Station 5	a Containers (20 to 30 gallons) b Plastic Liners c Bench or Stools
Station 2	a Containers (20 to 30 gallons) b Decontamination Solution c Rinse Water d 2 to 3 Long-Handled, Soft-Bristled Scrub Brushes	Station 6	a Plastic Sheets b Basin or Bucket c Soap and Towels d Bench or Stools
Station 3	a Containers (20 to 30 gallons) b Plastic Liners c Bench or Stools	Station 7	a Water b Soap c Tables d Wash Basin or Bucket
Station 4	a Air Tanks or Masks and Cartridges Depending Upon Level b Tape c Boot Covers d Gloves		

Maximum Measures for Level A Decontamination

Station 1	Segregated Equipment Drop	1	Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. During hot weather operations, a cool down station may be set up within this area.
Station 2	Boot Cover and Glove Wash	2	Scrub outer boot covers and gloves with decontamination solution or detergent/water
Station 3	Boot Cover and Glove Rinse	3.	Rinse off decontamination solution from Station 2 using copious amounts of water
Station 4	Tape Removal	4.	Remove tape around boots and gloves and deposit in container with plastic liner
Station 5	Boot Cover Removal	5.	Remove boot covers and deposit in container with plastic liner
Station 6	Outer Glove Removal	6	Remove outer gloves and deposit in container with plastic liner.
Station 7	Suit and Boot Wash	7.	Wash encapsulating suit and boots using scrub brush and decontamination solution or detergent/water. Repeat as many times as necessary.
Station 8	Suit and Boot	8	Rinse off decontamination solution using water. Repeat as many times as necessary.
Station 9	Tank Change	9	If an air tank change is desired, this is the last step in the decontamination procedure. Air tank is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty.
Station 10	Safety Boot Removal	10	Remove safety boots and deposit in container with plastic liner
Station 11	Fully Encapsulating Suit and Hard Hat Removal	11	Fully encapsulated suit is removed with assistance of a helper and laid out on a drop cloth or hung up. Hard hat is removed. Hot weather rest station may be set up within this area for personnel returning to site.
Station 12	SCBA Backpack Removal	12	While still wearing face piece, remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station.
Station 13	Inner Glove Wash	13	Wash with decontamination solution that will not harm the skin. Repeat as often as necessary.
Station 14	Inner Glove Rinse	14	Rinse with water. Repeat as many times as necessary.
Station 15	Face Piece Removal	15.	Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers.
Station 16	Inner Glove Removal	16	Remove inner gloves and deposit in container with liner.

Station 17. Inner Clothing Removal

17. Remove clothing and place in lined container. Do not wear inner clothing off site since there is a possibility that small amounts of contaminants might have been transferred in removing the fully encapsulating suit.

Station 18: Field Wash

18. Shower if highly toxic skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.

Station 19 Redress

19. Put on clean clothes.

Minimum Measures for Level A Decontamination

Station 1.	Equipment Drop	1	Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2	Outer Garment, Boots, and Gloves Wash and Rinse	2	Scrub outer boots, outer gloves, and fully encapsulating suit with decontamination solution or detergent and water. Rinse off using copious amounts of water.
Station 3	Outer Boot and Glove Removal	3.	Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4	Tank Change	4.	If worker leaves EZ to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5	Boots, Gloves, and Outer Garment Removal	5	Boots, fully encapsulating suit, and inner gloves removed and deposited in separate containers lined with plastic.
Station 6	SCBA Removal	6	SCBA backpack and face piece is removed (avoid touching face with fingers). SCBA deposited on plastic sheets.
Station 7	Field Wash	7	Hands and face are thoroughly washed. Shower as soon as possible.

Maximum Measures for Level B Decontamination

Station 1	Segregated Equipment Drop	1	Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2	Boot Cover and Glove Wash	2	Scrub outer boot covers and gloves with decontamination solution or detergent and water.
Station 3:	Boot Cover and Glove Rinse	3	Rinse off decontamination solution from Station 2 using copious amounts of water.
Station 4.	Tape Removal	4	Remove tape around boots and gloves and deposit in container with plastic liner.
Station 5.	Boot Cover Removal	5	Remove boot covers and deposit in container with plastic liner.
Station 6	Outer Glove Removal	6	Remove outer gloves and deposit in container with plastic liner.
Station 7	Suit and Safety Boot Wash	7.	Wash chemical-resistant splash suit, SCBA, gloves, and safety boots. Scrub with long-handle scrub brush and decontamination solution. Wrap SCBA regulator (if belt-mounted type) with plastic to keep out water. Wash backpack assembly with sponges or cloths.
Station 8.	Suit, SCBA, Boot, and Glove Rinse	8	Rinse off decontamination solution using copious amounts of water.
Station 9	Tank Change	9	If worker leaves EZ to change air tanks, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty.
Station 10.	Safety Boot Removal	10	Remove safety boots and deposit in container with plastic liner.
Station 11	SCBA Backpack Removal	11	While still wearing face piece, remove backpack and place on table. Disconnect hose from regulator valve.
Station 12	Splash Suit Removal	12.	With assistance of helper, remove splash suit. Deposit in container with plastic liner.
Station 13	Inner Glove Wash	13	Wash inner gloves with decontamination solution.
Station 14	Inner Glove Rinse	14	Rinse inner gloves with water.
Station 15.	Face Piece Removal	15	Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers.
Station 16	Inner Glove Removal	16	Remove inner gloves and deposit in container with liner.

Station 17 Inner Clothing Removal

17. Remove inner clothing Place in container with liner
Do not wear inner clothing off site since there is a
possibility that small amounts of contaminants might
have been transferred in removing the suit.

Station 18 Field Wash

18 Shower if highly toxic skin-corrosive or skin-absorbable
materials are known or suspected to be present Wash
hands and face if shower is not available

Station 19 Redress

19 Put on clean clothes

Minimum Measures for Level B Decontamination

Station 1	Equipment Drop	1	Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down station may be set up within this area.
Station 2	Outer Garment, Boots, and Gloves Wash and Rinse	2	Scrub outer boots, outer gloves, and chemical-resistant splash suit with decontamination solution or detergent water. Rinse off using copious amounts of water.
Station 3	Outer Boot and Glove Removal	3	Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Tank Change	4	If worker leaves EZ to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5	Boots, Gloves, and Outer Garment Removal	5.	Boots, chemical-resistant splash suit, and inner gloves removed and deposited in separate containers lined with plastic.
Station 6	SCBA Removal	6	SCBA backpack and face piece are removed. Avoid touching face with finger. SCBA deposited on plastic sheets.
Station 7	Field Wash	7	Hands and face are thoroughly washed. Shower as soon as possible.

Maximum Measures for Level C Decontamination

Station 1	Segregated Equipment Drop	1	Deposit equipment used on site (tools, sampling devices, and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area.
Station 2	Boot Cover and Glove Wash	2	Scrub outer boot covers and gloves with decontamination solution or detergent and water.
Station 3	Boot Cover and Glove Rinse	3	Rinse off decontamination solution from Station 2 using copious amounts of water.
Station 4	Tape Removal	4	Remove tape around boots and gloves and deposit in container with plastic liner.
Station 5	Boot Cover Removal	5	Remove boot covers and deposit in containers with plastic liner.
Station 6:	Outer Glove Removal	6	Remove outer gloves and deposit in container with plastic liner.
Station 7	Suit and Boot Wash	7.	Wash splash suit, gloves, and safety boots. Scrub with long-handled scrub brush and decontamination solution.
Station 8	Suit, Boot, and Glove Rinse	8	Rinse off decontamination solution using water. Repeat as many times as necessary.
Station 9	Canister or Mask Change	9	If worker leaves EZ to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty.
Station 10	Safety Boot Removal	10	Remove safety boots and deposit in container with plastic liner.
Station 11	Splash Suit Removal	11	With assistance of helper, remove splash suit. Deposit in container with plastic liner.
Station 12	Inner Glove Rinse	12	Wash inner gloves with decontamination solution.
Station 13	Inner Glove Wash	13	Rinse inner gloves with water.
Station 14	Face Piece Removal	14	Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers.
Station 15	Inner Glove Removal	15	Remove inner gloves and deposit in lined container.
Station 16	Inner Clothing Removal	16	Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off site since there is a possibility that small amounts of contaminants might have been transferred in removing the suit.

Station 17. Field Wash

17 Shower if highly toxic skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.

Station 18 Redress

18. Put on clean clothes

Minimum Measures for Level C Decontamination

Station 1	Equipment Drop	1	Deposit equipment used on site (tools, sampling devices, and containers, monitoring instruments, radios, clipboards, etc) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area.
Station 2	Outer Garment, Boots, and Gloves Wash and Rinse	2	Scrub outer boots, outer gloves, and splash suit with decontamination solution or detergent water. Rinse off using copious amounts of water.
Station 3	Outer Boot and Glove Removal	3	Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4	Canister or Mask Change	4	If worker leaves EZ to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5	Boots, Gloves, and Outer Garment Removal	5	Boots, chemical-resistant splash suit, and inner gloves removed and deposited in separate containers lined with plastic.
Station 6	Face Piece Removal	6	Face piece is removed. Avoid touching face with fingers. Face piece deposited on plastic sheet.
Station 7	Field Wash	7	Hands and face are thoroughly washed. Shower as soon as possible.

10.0 Emergency Response Procedures

The Fansteel site is located in an urban industrial area of North Chicago, Illinois. Emergency services are available by telephone using the 911 system or by dialing the local operator. A mobile telephone may be available on the site for use during emergencies. In the event that a telephone is not available at the site, written directions will be provided by the Site Health and Safety Officer to the nearest telephone.

The Site Health and Safety Officer will be responsible for ensuring that the telephone numbers provided for the local services are accurate. The Site Health and Safety Officer will ensure that project personnel are familiar with the local procedures and that a list of site emergency contacts is maintained at the work site at all times that work is being performed. The Site Health and Safety Officer will also be responsible for assuring that the local emergency response organizations will respond to the site in the event of an on-site emergency and to what extent they are trained in the hazards anticipated to be on the site.

The Health and Safety Officer will be responsible for documenting all Earth Sciences-related accidents/injuries. The Health and Safety Officer will evaluate site emergencies and determine what action is necessary. These actions may include, but are not limited to:

- Site evacuation
- Summon emergency assistance
- Administer first aid
- Suspend decontamination requirements
- Transport victim to a medical facility

All accidents and unusual events will be dealt with in a manner to minimize continued health risk of site workers.

10.1 Site Evacuation

In the event of life threatening emergency situations, a site may be evacuated. Such emergencies include fire, explosion, and spills of highly toxic materials. Personnel involved in an evacuation will report to the designated evacuation area in the SZ. If the emergency requires outside assistance or evacuation of an operating facility, the Site Health and Safety Officer will notify the appropriate provider. Employees are responsible for conducting themselves in a mature calm manner in the event of an accident/unusual event.

10.2 First Aid

Site personnel who have been trained by Earth Sciences in first aid and/or CPR have the responsibility to act in that capacity. Other personnel trained in first aid and/or CPR may choose to act as “Good Samaritans” in providing assistance in an emergency. Standards of good practice are expected to be followed by persons acting as first responders at the request of Earth Sciences.

The following procedures should be followed as a minimum when first aid is required:

- No person will act outside the scope of his/her training.
- Summon emergency assistance for any incident other than the most minor injuries. It is better to have assistance that is not needed than to need assistance that is not available.
- Provide assistance as appropriate for the incident. This assistance will be conducted in a manner to assure that those rendering assistance are not placed in a situation of unacceptable risk.
- Check victim for consciousness. Never give an unconscious person anything by mouth.
- Utilize the ABC of life support.
 - Check the airway
 - Check for breathing
 - Check the circulation (pulse)
- Control bleeding.
 - Apply direct pressure over the wound.
 - Apply pressure at the appropriate pressure point.
 - In the event of life threatening bleeding, a tourniquet may be used only under the direction of a physician. If a tourniquet is applied, it is assumed that the person will lose the limb.
- Treat for shock. Keep the person calm, still, and quiet. Keep the victim warm, except in the case of heat stress. Elevate the feet, except in the case of head or chest injury.
- Assess and splint broken bones.
- Treat burns.
 - Cool minor burns with water or water gel.
 - Bandage more serious burns. Seek immediate medical attention.
 - Do not apply ointments, grease, or butter to a burn.

- Clean and dress wounds.
 - A tetanus shot will be required for deep puncture wounds. The shot should be received within 2 days of the injury.
 - Deep or severe wounds require medical attention.
- Rinse chemicals from skin and eyes using copious amounts of cool water.
- If victim has ingested toxic materials, get medical attention. Contact the poison center for additional information.
- Do not move an injured person unless the location presents imminent danger.

10.3 Spill Control

Basic spill control can reduce the environmental impact and the health and safety concerns of a minor spill. Use proper PPE and exercise care when attempting to control even a small spill.

- Assess the spill.
 - Is the material hazardous, toxic, corrosive?
 - How much is spilled? Ounces? Quarts? Gallons?
- Stop the flow of material if it is safe to do so.
- Prevent the flow of material using sorbent socks, dikes, or booms.
- Absorb spilled materials with sorbents.
- Clean up sorbents and place in appropriate containers for management.
- Notify the Project Manager. He/she may be required to notify federal, state, or local spill management agencies.

Basic emergency equipment to be maintained at the site will include the following:

- First-aid kit
- Fire extinguishers
- Spill control materials

10.4 Directions to Lake Forest Hospital

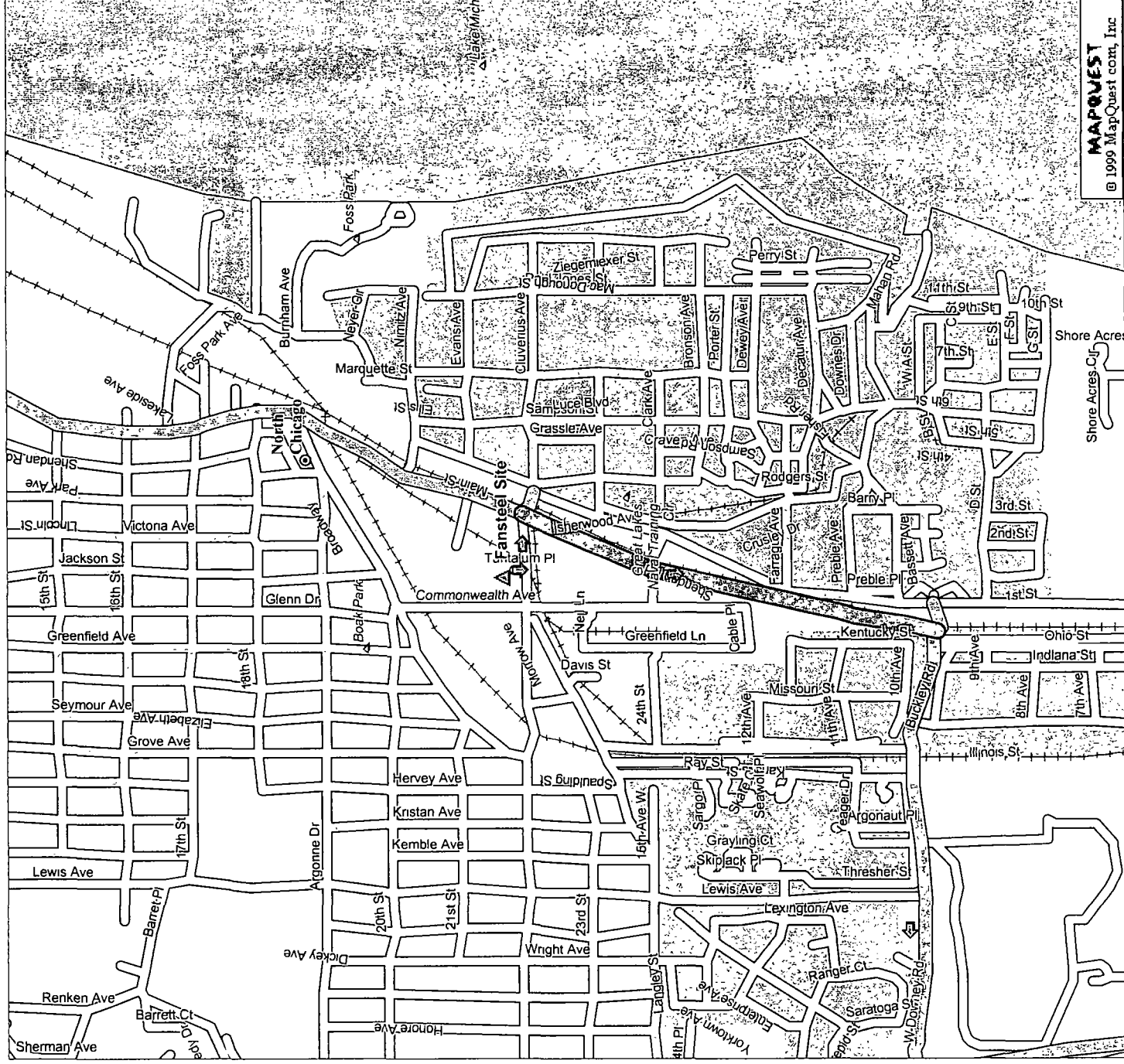
Exit site onto Tantalum Place. Follow Tantalum Place to Martin Luther King, Jr. Drive. Turn east (left) onto Martin Luther King, Jr. Drive. Continue on to the Amstutz Expressway. Turn onto the Expressway heading south (right). Follow the Amstutz Expressway to Buckley Road/Illinois Route 137. Turn west (right) onto Route 137. Follow Route 137 to North Waukegan Road/Illinois Route 43. Turn south (left) onto Route 43. Continue on Route 43 to West Dearpath Road. Turn east (left) onto West Dearpath Road.

Follow West Dearpath Road to North Westmoreland Road. Turn north (left) onto North Westmoreland Road. Hospital is at 660 North Westmoreland Road. Follow signs to the emergency room.

**Table 10-1
Emergency Contacts**

Service	Location	Telephone No.
Police, Ambulance	Lake County, IL	911
Lake Forest Hospital	660 N. Westmoreland Drive Lake Forest, IL 60045-1696	(847) 234-5600
Poison Information Center	National Capital	(202) 625-3333 (collect)
USEPA Region 5	77 West Jackson Boulevard Chicago, IL 60604-3507	(312) 353-2000 Within Region 5 (800) 621-8431
National Response Center		(800) 424-8802
CHEMTREC		(800) 424-9300
Donna L. Wilson Health and Safety Manager	Earth Sciences	Pager (800) 368-3092 Office (724) 733-3000 Home (412) 521-3643 Mobile (412) 576-7620
Robert D. Breakwell Project Manager	Earth Sciences	Office (724) 733-3000
To Be Determined Site Supervisor		Office Site
To Be Determined Health and Safety Officer		Office Site

Detail Map Fansteel Site

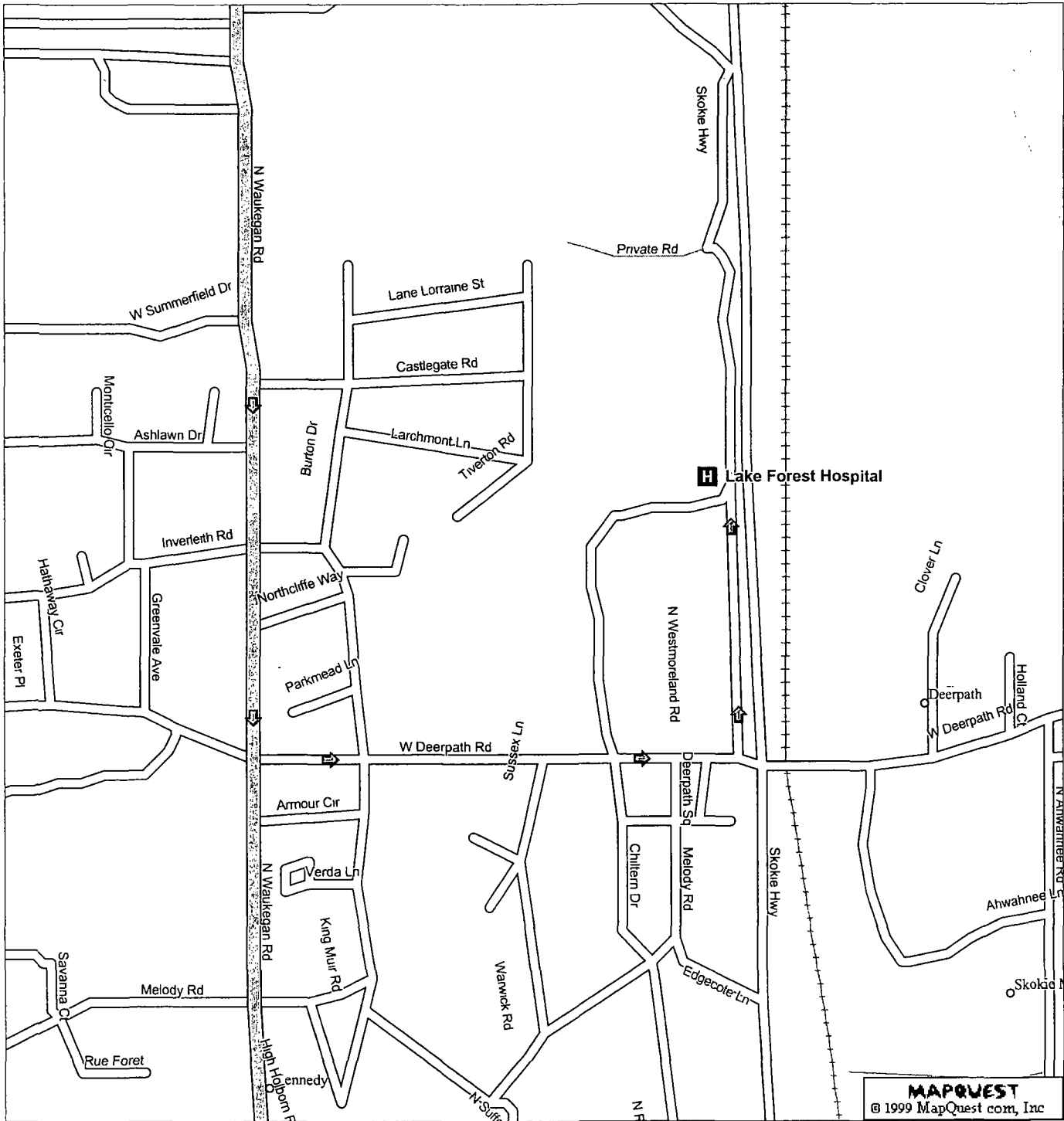


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Select
Streets
Deluxe

- Water
- Park
- Urban area
- Military land
- Airport
- Golf course
- Shopping Center
- Cemetery
- Hospital, university
- County border
- Ferry
- Limited access road
- Primary road
- Other road
- Unpaved or private road
- Railroad
- Geographic feature

Detail Map Lake Forest Hospital

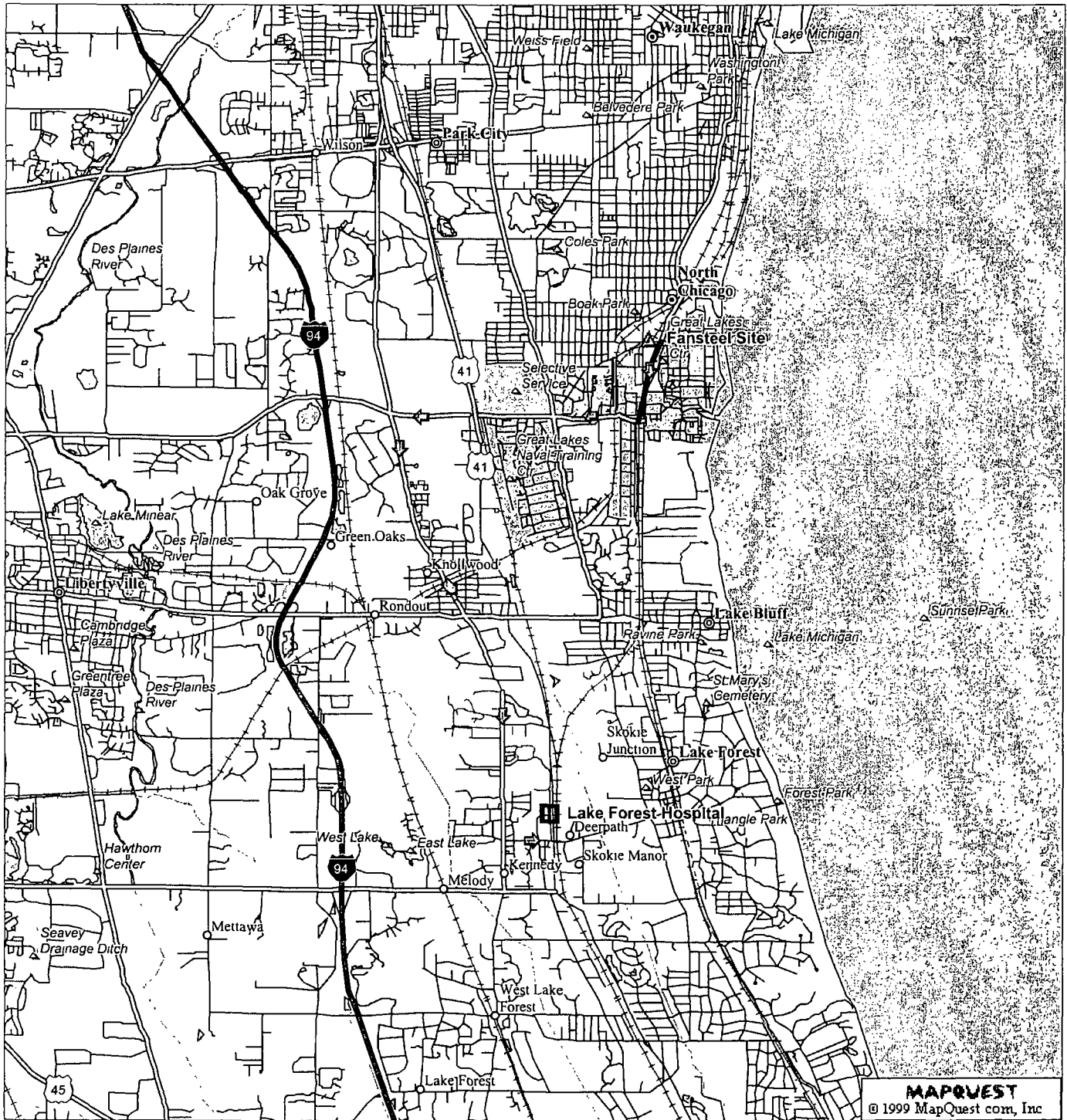


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- | | | |
|-----------------|----------------------|-------------------------|
| Water | Cemetery | Limited access road |
| Park | Hospital, university | Primary road |
| Urban area | County border | Other road |
| Military land | Ferry | Unpaved or private road |
| Airport | | Railroad |
| Golf course | | Geographic feature |
| Shopping Center | | |

**Select
Streets
Deluxe**

Overview Map to Lake Forest Hospital



MAPQUEST
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- | | | |
|-----------------|----------------------|-------------------------|
| Water | Cemetery | Limited access road |
| Park | Hospital, university | Primary road |
| Urban area | County border | Other road |
| Military land | Ferry | Unpaved or private road |
| Airport | | Railroad |
| Golf course | | Geographic feature |
| Shopping Center | | |

**Select
Streets
Deluxe**

11.0 Record Keeping

Site health and safety activities at the Fansteel site will be properly documented using appropriate forms. Any unusual events will be recorded on the daily log. The Site Health and Safety Officer may be required to maintain a health and safety log in addition to the operations log maintained by the site supervisor. These logs must be kept on site. Copies of the site health and safety log must be submitted for review on a weekly basis to the Health and Safety Manager. In the case of short duration projects, the health and safety logs should be submitted at the end of site operations.

Employees or their designated representatives will have access to their exposure and medical records as provided under 29 CFR 1910.20. Employees may seek access to their medical records by notifying the Human Resources Department. Exposure records may be accessed by notifying the Site Health and Safety Officer and/or the Health and Safety Manager.

OSHA regulations may be reviewed by employees. The Health and Safety Officer and/or supervising personnel will provide access to regulations that are kept on site. Other applicable regulations may be requested from the Health and Safety Manager.

11.1 On-Site Reference/Documentation Record Keeping and Reporting

The following reference materials are required to be present on site:

- Operations manuals for health and safety equipment
- General first aid and emergency information posted
- Earth Sciences' Health and Safety Policy Manual
- Health and Safety Standard Operation Procedures
- Material Safety Data Sheet (MSDS) Field Operations Package

The following documentation must be readily accessible from the on-site health and safety file:

- Completed Accident Report forms
- Written hazard communication program (29 CFR 1910.1200) which includes hazardous material inventory and MSDS.
- Calibration/measurement logs for all site health and safety equipment.
- Health and safety log.

11.2 Required Records

The information required to be documented by this site specific-specific health and safety plan shall be recorded in an official logbook and/or on logsheets which will serve as a document that can be audited to ensure the validity and completeness of health and safety operations. Although a health and safety log is required, some information will be recorded on logsheets; i.e., calibration information, monitoring instrument readings, and toolbox meetings. Information recorded on logsheets must be referenced in the health and safety log. All this information will be maintained on site for the duration of the job. Once the job has officially been completed, all records will be maintained with the project files as per 29 CFR 1910.120 (sample logsheets are found in the Health and Safety Policy Manual and/or attached to this health and safety plan).

11.3 Daily Information

The following information must be documented on a daily basis for site workers:

- Operation(s) performed.
- Time spent for each operation.
- PPE used for each operation.
- Equipment utilized.

The following information must be documented on a daily basis for the overall project:

- Environmental conditions (i.e., temperature, precipitation, cloud cover, wind speed, wind direction, etc.).
- Site visitors (include name, affiliation, and areas or operations visited).
- Site inspections.
- Training conducted.
- Health and safety problems encountered.
 - Personnel
 - Equipment
- Telephone/site meetings.
 - Health and safety concerns discussed
 - Health and safety decisions and rationale

11.4 Accident Report and Record Keeping

Supervisory personnel will complete accident reports and notify the Human Resources Department within 24 hours of the occurrence. Accidents which involve the death or injury and hospitalization of three or more employees must be reported immediately to the Health and Safety Manager, without regard to the constraints of working hours.

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Appendix A
Forms

**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Site Specific Training Record**

Project Name and Number _____ Date _____ Page ____ of ____

Instructor _____

Persons signing below indicate that they fully understand and will perform work in accordance with the Site Specific Health and Safety Plan for the above mentioned site. They understand and will abide by the health and safety requirements for work at this site and the Company health and safety policies and procedures. Additionally work will be performed in accordance with applicable federal, state and local regulations and the health and safety requirements imposed by the client.

Name	Signature	Affiliation	Date

I have reviewed the site health and safety plan for the _____ site, and understand the potential health and safety hazards at this operation and the emergency response procedures. I agree to conduct all on-site work in conformity with the requirements of the health and safety plan.

Project Number: _____ Date: _____

Reviewed by: Corp. H & S _____

Proj. Mgr. _____

**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Visitors' Log**

Project Number: _____

Project Name: _____

Site Superintendent: _____

Date	Time In/Out	Name/Representing	Purpose of Visit	Informed of Site Hazards (Y/N/NA)	Area Visited		
					Office	General Work	Exclusion Zone

AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Site Safety Inspection Checklist

Project Name and Number				Person Making Inspection
Job Site Location	Circle Appropriate Response			Date of Inspection
Y = Adequate at Time of Inspection	N = Needs Immediate Attention	NA = Not Applicable		
A Posters and Records				
1 OSHA poster displayed?	Y	N	NA	
2 EEOC poster displayed?	Y	N	NA	
3 OSHA 200 log posted?	Y	N	NA	
4 State Workers' Compensation information displayed?	Y	N	NA	
5 Copy of OSHA regulations on site?	Y	N	NA	
6 Site map posted?	Y	N	NA	
7 Emergency telephone numbers posted?	Y	N	NA	
8 Evacuation map posted?	Y	N	NA	
9 Map and directions to hospital posted?	Y	N	NA	
10 Health & Safety Policy Manual on site?	Y	N	NA	
11 29 CFR 1910/1926 available?	Y	N	NA	
12 Site-specific HASP on site?	Y	N	NA	
13 Does site-specific HASP reflect current conditions?	Y	N	NA	
14 MSDS available for chemical products on site?	Y	N	NA	
15 Required training documented on site?	Y	N	NA	
16 Safety meetings documented?	Y	N	NA	
17 Safety talk subjects available?	Y	N	NA	
18 Required medical records available?	Y	N	NA	
19 Inspections/operations documents?	Y	N	NA	
20 Daily H&S logs maintained?	Y	N	NA	
21 Sign-in sheet/Visitors' Log present?	Y	N	NA	
B Housekeeping				
22 General housekeeping of site adequate?	Y	N	NA	
23 Waste/trash stored in designated area?	Y	N	NA	
24 Adequate lighting in work areas?	Y	N	NA	
25 Work area free of slip, trip, and fall hazards?	Y	N	NA	
26 Smoking/eating areas established?	Y	N	NA	
C Decontamination and Sanitation				
27 Adequate toilet facilities?	Y	N	NA	
28 Toilet facilities clean?	Y	N	NA	
29 Hand wash facilities provided?	Y	N	NA	
30 Shower/decontamination facilities provided?	Y	N	NA	
31 Shower/decontamination facilities clean and orderly?	Y	N	NA	
32 Sanitary drinking water supplied?	Y	N	NA	
33 Disposable cups available?	Y	N	NA	
34 Appropriate waste container provided for disposable cups?	Y	N	NA	
35 Decontamination area established?	Y	N	NA	
36 Decontamination area adequately supplied?	Y	N	NA	
37 Decontamination procedures followed?	Y	N	NA	
38 Decontamination solutions properly disposed?	Y	N	NA	
D Emergency Response				
39 Emergency response coordinator identified?	Y	N	NA	
40 First aid/CPR trained individual on site?	Y	N	NA	
41 Emergency response plan available?	Y	N	NA	
42 Personnel familiar with emergency response plan?	Y	N	NA	
43 Internal communication system established?	Y	N	NA	
44 External communication system established?	Y	N	NA	
45 Off-site emergency/rescue procedures established?	Y	N	NA	
46 Off-site emergency/rescue departments contacted?	Y	N	NA	
47 First aid kit available?	Y	N	NA	
48 First aid kit adequately stocked?	Y	N	NA	
49 Spill control supplies available?	Y	N	NA	
50 Emergency decontamination procedures planned?	Y	N	NA	
51 Evacuation drill conducted?	Y	N	NA	
E. Tools				
52 Damaged or broken tools tagged and removed from service?	Y	N	NA	
53 Machine guards in place on all power tools?	Y	N	NA	
54 Trained personnel operating power tools?	Y	N	NA	
55 Tools properly used?	Y	N	NA	
56 Tools properly stored?	Y	N	NA	
F PPE				
57 Correct PPE in use?	Y	N	NA	
58 Sufficient quantities of approved PPE?	Y	N	NA	
59 Personnel trained in PPE use?	Y	N	NA	
60 Hard hat, safety eyewear, and hard-toe boots worn on site?	Y	N	NA	
61 Hearing protection in use?	Y	N	NA	
62 Personnel fit tested?	Y	N	NA	
63 Respirators stored properly?	Y	N	NA	
64 Respirators inspected before use?	Y	N	NA	
65 Respirators cleaned/disinfected properly?	Y	N	NA	
66 Appropriate APR cartridges available?	Y	N	NA	
67 Fit check performed before entering contaminated areas?	Y	N	NA	
68 Manifolds, regulators, and air lines inspected before use?	Y	N	NA	
69 Manifolds, regulators, and air lines maintained?	Y	N	NA	
70 SCBAs inspected monthly?	Y	N	NA	
71 SCBAs inspected/serviced after use?	Y	N	NA	
G Fire Safety				
72 Appropriate warning signs posted for flammable materials areas?	Y	N	NA	
73 Appropriate fire suppression equipment provided?	Y	N	NA	
74 Fire extinguishers inspected monthly?	Y	N	NA	
75 Fire department notified of site hazards?	Y	N	NA	
76 Access for fire fighting equipment/personnel provided?	Y	N	NA	
77 Approved flammable storage containers/cabinets used?	Y	N	NA	
78 Containers labeled?	Y	N	NA	
79 Gas cylinders secured?	Y	N	NA	
80 Out-of-service cylinders capped?	Y	N	NA	
81 Combustibles/oxidizers or incompatible materials separated by at least 30 feet?	Y	N	NA	
82 Spotters/fire extinguishers posted in "hot work" areas?	Y	N	NA	
83 Adequate ventilation of gas-/diesel-powered equipment?	Y	N	NA	
H Structures				
84 Walk/work surfaces free of slip, trip, and fall hazards?	Y	N	NA	
85 Walkways properly maintained?	Y	N	NA	
86 Roadways properly maintained?	Y	N	NA	
87 Openings guarded?	Y	N	NA	
88 Standard guardrails on scaffolds/platforms/walkways?	Y	N	NA	
89 Toe boards in place on scaffolds/platforms/overhead work areas?	Y	N	NA	
90 Scaffolds/platforms/ladders properly anchored, braced, and constructed?	Y	N	NA	
91 Ladders extend at least 3 feet above landings?	Y	N	NA	
92 Fall protection in place?	Y	N	NA	
93 Lanyards/harnesses/life lines used?	Y	N	NA	
94 Fixed ladders firmly anchored to structure(s)?	Y	N	NA	

Site Safety Inspection Checklist (continued)

Y = Adequate at Time of Inspection

Circle Appropriate Response

N = Needs Immediate Attention

NA = Not Applicable

I Heavy Equipment and Vehicles

95 Equipment inspected before use?	Y	N	NA
96 Operators trained/experienced on equipment?	Y	N	NA
97 Unattended equipment turned off?	Y	N	NA
98 Equipment shut off during refueling?	Y	N	NA
99 Blades lowered on unattended equipment?	Y	N	NA
100 Spotter used when visibility is limited?	Y	N	NA
101 Safe operating speeds observed?	Y	N	NA
102 Machine guards in place?	Y	N	NA
103 Horns and alarms functioning?	Y	N	NA
104 Seat belts in use?	Y	N	NA
105 Rollover protection provided?	Y	N	NA

M Comments and/or Actions Taken to Correct Items Needing Immediate Attention

J Electrical

106 GFCIs in use?	Y	N	NA
107 Electrical cords in good condition?	Y	N	NA
108 Explosionproof/low-voltage lighting used?	Y	N	NA
109 Temporary lighting protected?	Y	N	NA
110 Lockout/tagout procedures followed?	Y	N	NA
111 Safe distances observed from high-voltage lines?	Y	N	NA

K Excavation and Trenching

112 Utilities contacted and lines marked?	Y	N	NA
113 Trench shored/sloped/boxed adequately?	Y	N	NA
114 Means of access/egress within 25 feet?	Y	N	NA
115 Daily inspections conducted?	Y	N	NA
116 Inspections conducted after storm events?	Y	N	NA
117 Evaluation for hazardous atmospheres conducted?	Y	N	NA
118 Warning system for equipment along top of excavation?	Y	N	NA
119 Traffic control adequate?	Y	N	NA

L Hazardous Conditions

120 Confined space entry procedure followed?	Y	N	NA
121 Hazardous atmospheres evaluated?	Y	N	NA
122 HazCom program in place?	Y	N	NA
123 Chemicals properly labeled?	Y	N	NA
124 Chemicals properly stored?	Y	N	NA
125 Site-specific HSP available?	Y	N	NA
126 Asbestos procedures followed?	Y	N	NA
127 Lead procedures followed?	Y	N	NA
128 Heat/cold stress prevention measures taken?	Y	N	NA
129 Correct lifting techniques used?	Y	N	NA

I, the undersigned supervisor, have reviewed the indicated hazards and will take the necessary action to immediately correct them

Signature of Project Supervisor

Date

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**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Air Line Respirator Checklist**

Project Name and Number		Person Making Inspection	
Job Site Location		Date of Inspection	
Y = Adequate at Time of Inspection		Circle Appropriate Response N = Needs Immediate Attention NA = Not Applicable	
A Bottles		G. Masks	
1 Grade D Breathing Air available?	Y N NA	28 Fit check performed prior to each use?	Y N NA
2 Sufficient quantity for 1-1/2 days of operation present on site?	Y N NA	29. Fit testing performed?	Y N NA
3 Fittings free of grease, oil, and debris?	Y N NA	30. Facepiece inspected for defects?	Y N NA
		31. Breathing tube inspected for defects?	Y N NA
		32. Damaged masks tagged and removed from service?	Y N NA
B Regulators		H System	
4 Proper two-stage regulators available?	Y N NA	33 System leak tested?	Y N NA
5 Regulators undamaged?	Y N NA	34 Fittings compatible (Foster/Hansen/Shrader)?	Y N NA
6 Regulators equipped with proper fittings?	Y N NA		
7 Regulators free of grease, oil, and debris?	Y N NA		
8 Regulators leak tested and free of leaks?	Y N NA		
9 Damaged, leaking, or faulty regulators tagged and removed from service?	Y N NA	I. Miscellaneous	
10 Proper regulator assembly in use? (NEVER "ng" a system)	Y N NA	35 Personnel trained in respirator use?	Y N NA
		36 Escape bottles in use (Hip-Air/5-Minute Escape/Dual-Purpose SCBA)?	Y N NA
		37 Backup system for rescue (SCBA/redundant/compressor)?	Y N NA
		38 Communications system in place (in facepiece/external radio signals)?	Y N NA
C Connectors		J Comments and/or Actions Taken to Correct Items Needing Immediate Attention	
11 Connectors leak tested and free of leaks?	Y N NA		
12 Connectors undamaged and free of kinks or breaks?	Y N NA		
13 Extra connectors available?	Y N NA		
14 Connectors of proper size and design available?	Y N NA		
15 Connectors used to fit a regulator?	Y N NA		
D Manifolds			
16 Manifolds leak tested?	Y N NA		
17 Proper manifolds available for setup?	Y N NA		
18 Proper fittings, plugs, and connectors in use?	Y N NA		
E Tubings and Lines			
19 Lines leak tested?	Y N NA		
20 Flexible line less than 300 feet in length?	Y N NA		
21 Hard plumbing in use for lines in excess of 300 feet?	Y N NA		
22 Line ends equipped with proper fittings?	Y N NA		
23 Worn, frayed, or damaged lines tagged and removed from services?	Y N NA		
F Fittings			
24 Fittings designed for use in air line systems?	Y N NA		
25 Fittings direct connect to bottles, regulators, or lines?	Y N NA		
26 Quick connects engage and disengage freely?	Y N NA		
27 Fittings free of grease, oil, and debris?	Y N NA		
		I, the Undersigned supervisor, have reviewed the indicated hazards and will take the necessary action to immediately correct them	
		Signature of Project Supervisor	
		Date	

**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Exclusion Zone Operations Record**

Project Name and Number _____ Date _____ Page ____ of ____

Location of Exclusion Zone _____

Pre-Entry Briefing Conducted (Circle One) Yes/No

Air Monitoring Results

TIME	INSTRUMENT	READING	UNITS

Personnel Entry Log

Entrant	PPE Level	Time In	Decontamination Procedures	Instrument Reading	Time Out

Health and Safety Officer: _____

**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Hazardous Materials Spill Report**

Project Name: _____ Project Number: _____

Site Address: _____

Telephone Number: _____

Type of Occurrence:
_____ Spill _____ Fire _____ Explosion _____ Other: _____

Date of Event: _____ Time of Event: _____

Name and Quantity of Material(s) Involved: _____

Possible Source of Release: _____

Extent of Injuries (If any): _____

Assessment of Actual or Potential Hazards to Human Health or the Environment: _____

Estimated Quantity and Disposition of Recovered Material from Incident: _____

Remedial Action Taken or Planned to Minimize Environmental Damage: _____

Reported By (Print Name): _____

Signature: _____

Title: _____ Date: _____

**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Health and Safety Field Activity Report**

Project Name and Number _____ Date _____ Page ____ of ____

Health and Safety Officer _____

Time

Field Activities

**Health and Safety Field Activity Report
(Continued)**

Project Name and Number _____ Date _____ Page ____ of ____

Health and Safety Officer _____

Air Monitoring Data

Instrument Calibration Data

H-Nu

Model Number

Serial Number

Calibration Gas Batch Number

Calibration Gas Concentration

Expected Value

Observed Value

OVA

Model Number

Serial Number

Calibration Gas Batch Number

Calibration Gas Concentration

Expected Value

Observed Value

**Health and Safety Field Activity Report
(Continued)**

Project Name and Number _____ Date _____ Page ____ of ____

Health and Safety Officer _____

Air Monitoring Data (continued)

Instrument Calibration Data (continued)

LEL/O ₂ Meter	Model Number	Serial Number
	_____	_____
	Calibration Gas Batch Number	_____
	Calibration Gas Concentration	_____
LEL	Expected Value	Observed Value
	_____	_____
	_____	_____
O ₂	Expected Value	Observed Value
	_____	_____
Other Type	Model Number	Serial Number
	_____	_____
	Calibration Gas Batch Number	_____
	Calibration Gas Concentration	_____
	Expected Value	Observed Value
	_____	_____

**Health and Safety Field Activity Report
(Continued)**

Project Name and Number _____ Date _____ Page ____ of ____

Health and Safety Officer _____

Health Physics Monitoring Data

Instrument Calibration Data

Alpha Scintillator	Model Number	Serial Number
	_____	_____

Source Element/Isotope

Expected Value	Observed Value	Efficiency
_____	_____	_____

Beta/Gamma Counter	Model Number	Serial Number
	_____	_____

Source Element/Isotope

Expected Value	Observed Value	Efficiency
_____	_____	_____

Gamma Scintillator	Model Number	Serial Number
	_____	_____

Expected Value	Observed Value	Efficiency
_____	_____	_____

**Health and Safety Field Activity Report
(Continued)**

Project Name and Number _____ Date _____ Page ____ of ____

Health and Safety Officer _____

Field Air Monitoring Data

Field Data

Location _____

Activities _____

TIME	INSTRUMENT	READING	UNITS

Operator's Signature _____

**Health and Safety Field Activity Report
(Continued)**

Project Name and Number _____ Date _____ Page ____ of ____

Health and Safety Officer _____

Field Health Physics Monitoring Data

Field Data

Location _____

Activities _____

TIME	INSTRUMENT	READING	UNITS

Operator's Signature _____

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Hot Work Permit

Project Name/Number _____ Date _____

Welder Name _____

Spotter Name _____

Operations being performed (Check One)

Brazing _____ Cutting _____ Welding _____ Other (specify) _____

Describe Work to be Performed _____

Location of Operation (Specify Work Area)

Indoors _____ Outdoors _____

Type of Torch (Check One)

Oxyacetylene _____ Arc _____ Other (specify) _____

Safety Precautions (Supply all requested information. Enter NA if an item does not apply.)

Air monitoring required _____ Enter Time _____ LEL _____ O₂ _____

Area secured from unauthorized entry and posted _____

Nonessential personnel excluded from area _____

Cleaning/purging of work required _____

Confined space entry permit required _____

Cylinders mounted on appropriate welding cart and/or properly secured _____

Extra cylinders stored at least 35 feet from operation _____

No flammable materials within 35 feet of operations _____

Fire Spotter (specify number/location) _____

Fire Extinguisher (specify number/type) _____

Inerting (specify inerting material) _____

Lockout/tagout (specify service) _____

Safety Equipment (Check All That Apply)

Welding Goggles _____ Welding Helmet _____ Gloves _____ Gauntlets _____ Chaps _____ Leather Welding Jacket _____ Fume Hood _____ Exhaust Ventilation _____

Air Purifying Respirator (HEPA Cartridges) _____ SCBA _____ Airline _____

Approved by: Site Supervisor _____

Site Health and Safety Officer _____

Reviewed by: Health and Safety Coordinator _____ Date _____

Report of Accident

Company:

☐ Antech

☐ Earth Sciences

☐ AWSR

☐ Export/Blue Bell

☐ Export

☐ Ohio

Date of Accident: _____ Time of Accident: _____

Employee's Name: _____

Employee's Address (Include county): _____

Telephone Number: _____

Date Employer Knew of Accident: _____

Address Where Accident Occurred (Include county): _____

Nature and Location of Injury (Describe part of body affected): _____

Was First Aid Administered? ☐ Yes ☐ No By Whom?: _____

Was Medical Treatment Required? ☐ Yes ☐ No

If Yes, Name the Facility and Give Address. _____

Last Date/Time Worked: _____ Is Employee Back to Work? ☐ Yes ☐ No

If Yes, Date Returned: _____

What was Employee's Assigned Position and What Work was Being Performed When Accident Occurred?

(Be specific, describe tools, equipment, handling of material, what task was being performed, etc.):

How Did the Accident Occur? (Describe the events which resulted in injury/disease, tell what happened, how it happened):

Who were the Witnesses to Accident?(If none, state so): _____

Did Injury Occur Because of

Mechanical Defect? ☐ Yes ☐ No Unsafe Act? ☐ Yes ☐ No

If Answer is Yes, Please Describe: _____

Can this Accident Happen Again? ☐ Yes ☐ No

What has been Done to Prevent a Reoccurrence? _____

What Other Control Measures can be Taken and by Whom? _____

Employee Signature and Date

Supervisor Signature and Date

Forward Original to Human Resources Department

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**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Confined Space Entry Permit**

Project Name _____ Project Number _____

Site/Location _____

Date & Time Issued _____ Expiration Date & Time _____

Type of Space (Select One) Tank Vault Manhole Other _____

Work to be performed _____

Safety Precautions (Select all that apply) Lockout/Tagout Flush/Purge Ventilation Blank/Cap Post Area Hot Work Permit
Other _____

Personal Protective Equipment (Select all that apply) Hard Hat Safety Glasses Respirator Coveralls Gloves Rubber Boots
Other _____

Entrant Information

Name	PPE (Y/N)	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out

Attendant Information

Name	Time	Relieved By	Time

Emergency Response Information

Communication Procedures _____

Rescue/Support Equipment _____

Rescue Procedure _____

Atmospheric Monitoring

Time	Oxygen (%)	Explosive (% LEL)	Organic Vapors (ppm)	Other	Other	Other

Site Supervisor Signature _____ Date _____

Permit must remain at job site during operations Return forms to Health and Safety Coordinator for review following completion of job

AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Emergency Reference
(Post this notice and map at site.)

Emergency Numbers

Ambulance

Doctor

Hospital

Fire Department

Police

Sheriff

National Response Center

ChemTrec

National Poison Control Center

AWS Remediation, Inc. Spill Reporting (after hours)

AWS Remediation, Inc. Health and Safety (after hours)

Directions to Emergency Room

(Post map with route highlighted.)

Utility Numbers

Call Before You Dig

Electric Company

Water Company

Gas Company

AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Personal Protective Equipment Selection Questionnaire

Contaminant of Concern _____

Chemical Trade Name _____ Chemical Formula _____

Maximum expected concentration of the Contaminant of Concern _____

Physical State of the Contaminant of Concern (circle one) Solid/Liquid/Gas

Chemical Properties of the Contaminant of Concern (circle all that apply)

Pure substance/Mixture Organic/Inorganic Acid/Base/Poison/Reactive/Toxic

Other _____

Health and Safety Properties of the Contaminant of Concern

PEL/TLV _____ IDLH Concentration _____ Odor Threshold _____

Potential Routes of Exposure (circle all that apply) Absorption/Ingestion/Inhalation

Potential Hazards Associated with the Contaminant of Concern

IDLH/Flammable/Oxygen Deficiency/Irritant/Corrosive Other _____

Additional Hazards Presented by Operations (circle all that apply)

Decreased Temperature/Increased Temperature/Mixing/Spreading/Wetting Other _____

Personal Protective Equipment Requirements

Body _____

Eyes _____

Face _____

Feet _____

Hands _____

Head _____

Hearing _____

Respiratory _____

Other _____

Health and Safety Coordinator _____ Date _____

ACCIDENT REPORT CARD

☐ a.m.

Date of accident: _____ Time of day: _____ ☐ p.m.

Other vehicle(s) involved* - consider your vehicle as #1.

Vehicle #1

Vehicle #2

License plate #		
Year, Make & Model		
Owner's Name		
Street Address		
City, State, Zip		
Phone #		

Driver's Name		
Street Address		
City, State, Zip		
License #, state		
Home phone #		
Business phone #		

Passenger #1 name		
Street Address		
City, State, Zip		
Home phone #		
Business phone #		

Passenger #2 name		
Street Address		
City, State, Zip		
Home phone #		
Business phone #		

Your name:		Vehicle #
Street Address		Number of passengers
City, State, Zip		
Home phone #		
Business phone #		

Names of injured*	Phone #	Location at time of accident	Extent of injuries

Name of the hospital(s) the injured were taken to* (if any):	

EQUIPMENT DAMAGE REPORT*

Report Date

Company:

Antech Ltd.

Earth Sciences Consultants, Inc.

 AWS Remediation, Inc.

Export/Blue Bell

Export

Denver

Denver

Ohio

Event Date:

Time of Event:

Project No.: _____

Project Name: _____

Client Name: _____

Client Address: _____

Name of Person Filing Report: _____

Job Title: _____

Address: _____

Describe How Event Occurred (Be specific, describe circumstances - equipment, tools, task being performed):

[illegible]

**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Site Health and Safety Needs Assessment Form**

Project Number _____ Date _____

Project/Client Name _____

Project Manager _____

Site Supervisor _____

Project Start Date _____ Project Ending Date _____

Client Contact

(Provide the name and telephone number of client representative who can provide additional site information.)

Name _____ Telephone Number () _____

Site Operations

(Provide a detailed description of the operations being performed or attach the work plan.)

Site Hazards

(Provide list of site chemical and physical hazards, analytical data, and/or process description.)

Site Security Measures

(Provide list of security features, i.e., fencing, guards, etc.)

Site Location

(Provide directions to the site. Include the address of facility and a map if available.)

Emergency Facilities

(Provide the name, address, and telephone number of hospital, police, etc.)

Return the completed form to Donna L. Wilson, Health and Safety Coordinator.

**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Rental Equipment Decontamination Record**

Equipment Identification

Type of Equipment: _____

Model: _____

Serial Number: _____

Rented from (Name and Address): _____

Decontamination

Decontamination Method: _____

Date of Decontamination: _____

Site Name: _____

Project Number: _____

Decontamination Certification

Name: _____

Title: _____

Signature: _____

Date: _____

**AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Respirator Fit Test Record**

Name _____

Date of Test _____

Testing Agent Isoamyl Acetate _____ Bitrex _____

Respirator(s) Tested _____

Respirator(s) Passed _____

Health and Safety Officer's Signature

[illegible]

Week Ending: _____

[illegible]

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**Antech Ltd.
AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Safety Meeting Sign-in Sheet**

Topic: _____

Instructor: _____

Date: _____ Time: _____

Location: _____

Legibly print your name as you wish it to appear on your certificate in the appropriate box below. Confirm your attendance by signing your name in the adjacent signature box. Print your company name in the affiliation box. Provide an address if requested.

Name	Signature	Affiliation

Instructor's Initials _____ Attendance Total _____

AWS Remediation, Inc./Earth Sciences Consultants, Inc.

SCBA Checklist

Model. _____	Date _____						
Serial Number: _____		Pass:	Fail:	Pass:	Fail:	Pass:	Fail:
Cylinder and Cylinder Assembly							
Check cylinder label for hydrostatic test date, within 3 years (5 years for steel tank.)							
Inspect tank for large dents or gouges in metal/fiberglass							
Inspect cylinder gauge and threads.							
Open cylinder valve to clear any obstructions.							
Preparation for Inspection							
Check that high-pressure connector O-ring is present.							
Check that high-pressure hose connector is tight on cylinder fitting.							
Check that mainline valve is closed Check that regulator outlet is not covered or obstructed							
Backpack and Harness Assembly							
Inspect for complete set of straps that are not damaged or contaminated.							
Check wear and function of buckle							
Check backplate for damage and attachment to cylinder.							
Cylinder and High-Pressure Hose Assembly							
Check cylinder to assure that it is firmly fastened to backplate							
Open cylinder valve; listen or feel for leakage around packing and hose connection							
Check high-pressure hose for damage or leaks.							
Regulator and Low-Pressure Alarm							
Cover regulator outlet with palm of hand Open mainline valve Note stoppage of airflow after positive pressure builds Close mainline valve							
Remove hand from regulator outlet Open bypass valve. Cover regulator outlet with palm of hand Open mainline valve Note pressure reading on regulator gauge, it should read a minimum of 1,800 psi.							
Close cylinder valve while keeping hand over regulator outlet. Slowly remove hand from outlet and allow air to flow. Note pressure when low-pressure warning alarm sounds; it should read between 550 psi to 650 psi. Remove hand from regulator outlet Close mainline valve							
Check regulator for leaks; blow air into regulator for 5 to 10 seconds; suck air from outlet for 5 to 10 seconds. (NOTE: If positive pressure of vacuum can not be maintained, do not use SCBA)							
Facepiece and Breathing Tube							
Visually inspect head harness for cuts, damage, and deteriorated rubber.							
Visually inspect lens for proper seal in facepiece							
Stretch breathing tube and carefully inspect for holes and deterioration.							
Inspect connector for damage and presence of O-ring							
Visually inspect exhalation valve for buildup of foreign materials							
Remove the retaining ring from inside mask and be sure that speaking diaphragm and mask O-ring are in proper position							
Ensure that wagon wheel and disc valve are in good condition							
Ensure that neck strap is not damaged or contaminated							
Inspection Result							
Unit to remain in service (If unit fails, remove from service)							

NOTE Before returning to storage, be sure that all valves are closed, pressure is released from high-pressure hose, and straps are fully extended

Comments _____

Signature of Inspector _____

Date _____

Signature of Inspector _____

Date _____

Signature of Inspector _____

Date _____

Antech Ltd.
AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Personal Sampling Data Sheet

Project Name _____ Project Number _____ Date _____ Page ____ of ____

Personal Sampling Data

Sample Number	Sample Location	Pump ID	Worker ID	Parameters	Media	Time			Flow Q_T (lpm)	Total Volume (liters) ($t \cdot Q_T$)	Comments
						Start	Stop	Total (minutes)			

Sampling Technician's Signature _____

**Personal Sampling Data Sheet
(continued)**

Page ____ of ____

Calibration Data

Pump ID	Media	Volume (liters)	Time (seconds)	Flow (lpm) (V/t*60)	Average Flow Q_T $[(Q_1+Q_2+Q_3)/3]$

Calibration Technician's Signature _____

AWS Remediation, Inc.
Earth Sciences Consultants, Inc.
Personnel Data Record

A copy of each applicable certification (for indicated training date) must be forwarded
to the Health and Safety Department within 7 days of starting date.

Employee

Name: _____

Address: _____

Home Telephone No.: _____ Local Telephone No.: _____

Start Date: _____ Position: _____

Social Security No.: ____/____/____

Training Dates

40-Hour Hazardous Waste: _____ 8-Hour Refresher: _____

8-Hour Supervisor: _____ Site Safety and Health Officer: _____

Confined Space: _____ HazCom: _____

First Aid: _____ CPR: _____

Respirator Fit-Test: _____ Other: _____

To be Notified in Case of Injury/Illness

Name: _____ Relationship: _____

Address: _____

Home Telephone No.: _____ Work No.: _____

For Office Use Only

Received by Health and Safety Department: _____ Date: _____

Entered into Database by: _____ Date: _____

Health and Safety Manual: _____ Date: _____

Appendix B

NIOSH Quick Guide Information on Specific Chemicals

1,2-Dichloroethylene 540-59-0

Structure: ClCH=CHCl

Conversion Factor: 1 ppm = 3.97 mg/m³

RTECS Number: KV9360000

DOT ID and Guide Number: 1150 132P

Synonyms and Trade Names: Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene

Exposure Limits and IDLH

IDLH: 1000 ppm

Odor Threshold: 0.08-17 ppm

NIOSH DATA

TWA: 200 ppm (790 mg/m³)

STEL:

Ceiling:

Notes:

OSHA DATA

TWA: 200 ppm (790 mg/m³)

STEL:

Ceiling:

Notes:

Chemical and Physical Properties

Molecular Weight: 97.0

Solubility: 0.4%

Vapor Pressure: 180-265 mmHg

Specific Gravity: (77°F): 1.27

Boiling Point: 118-140°F

RGAsD:

Freezing Point: -57 to -115°F

MEC:

Flash Point: 36-39°F

Ionization Potential: 9.65 eV

Upper Explosive Limit: 12.8%

Lower Explosive Limit: 5.6%

Flammability: Class IB Flammable Liquid

Physical Description: Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.

Incompatibilities and Reactivities: Strong oxidizers, strong alkalis, potassium hydroxide, copper [Note: Usually contains inhibitors to prevent polymerization.]

Measurement Methods

Collection Method: Charcoal tube

Sample Work-up: Carbon disulfide

Analytical Method: Gas chromatography with flame ionization detection

Method Number: [#1003, Halogenated Hydrocarbons]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100 degrees F).

The following equipment should be available: No recommendation given

Recommendations for Respirator Selection

NIOSH/OSHA RECOMMENDATIONS

*2000 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(Substance causes eye irritation or damage; eye protection needed)

(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

(Substance causes eye irritation or damage; eye protection needed)

(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

*(Emergency or planned entry into unknown concentrations or IDLH conditions):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, Respiratory System; Central Nervous System Depressant/Depression

Organs affected by exposure to this substance are: Eyes, Respiratory system, Central Nervous System

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Acetone 67-64-1

Structure: $(\text{CH}_3)_2\text{CO}$

Conversion Factor: 1 ppm = 2.38 mg/m³

RTECS Number: AL3150000

DOT ID and Guide Number: 1090 127

Synonyms and Trade Names: Dimethyl ketone, Ketone propane, 2-Propanone

Exposure Limits and IDLH

IDLH: 2500 ppm [LEL]

Odor Threshold: 3.6-653 ppm

NIOSH DATA

TWA: 250 ppm (590 mg/m³)

STEL:

Ceiling:

Notes:

OSHA DATA

TWA: See Appendix G for vacated 1989 OSHA PEL. 1000 ppm (2400 mg/m³)

STEL:

Ceiling:

Notes: :1989 OSHA PEL: TWA 750 ppm (1800 mg/m³) ST 1000 ppm (2400 mg/m³)

Chemical and Physical Properties

Molecular Weight: 58.1

Solubility: Miscible

Vapor Pressure: 180 mmHg

Specific Gravity: 0.79

Boiling Point: 133°F

RGAsD:

Freezing Point: -140°F

MEC:

Flash Point: 0°F

Ionization Potential: 9.69 eV

Upper Explosive Limit: 12.8%

Lower Explosive Limit: 2.5%

Flammability: Class IB Flammable Liquid

Physical Description: Colorless liquid with a fragrant, mint-like odor.

Incompatibilities and Reactivities: Oxidizers, acids

Measurement Methods

Collection Method: Charcoal tube

Sample Work-up: Carbon disulfide

Analytical Method: Gas chromatography with flame ionization detection

Method Number: [#1300, Ketones I]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection. Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection. Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100 degrees F).

The following equipment should be available: NO RECOMMENDATION GIVEN

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*2500 ppm:

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)

(Substance reported to cause eye irritation or damage; may require eye protection)

(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

(Substance reported to cause eye irritation or damage; may require eye protection)

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

(APF = 10) Any supplied-air respirator

(Substance reported to cause eye irritation or damage; may require eye protection)

(APF = 50) Any self-contained breathing apparatus with a full facepiece

*(Emergency or planned entry into unknown concentrations or IDLH conditions):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, nose, throat; Headache, Dizziness, Central Nervous System Depressant/Depression; Dermatitis

Organs affected by exposure to this substance are: Eyes, skin, Respiratory system, Central Nervous System

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Cadmium dust (as Cd) 7440-43-9

Structure: Cd (metal)

Conversion Factor:

RTECS Number: EU9800000 (metal)

DOT ID and Guide Number: 2570 154 (compounds)

Synonyms and Trade Names: Cadmium metal: Cadmium Other synonyms vary depending upon the specific cadmium compound.

Exposure Limits and IDLH

IDLH: 9 mg/m³ (as Cd)

Odor Threshold: not given

NIOSH DATA

TWA: NIOSH considers this substance to be an occupational carcinogen. See Appendix A

STEL:

Ceiling:

Notes: [*Note: The REL applies to all Cadmium compounds (as Cd).]

OSHA DATA

TWA: 0.005 mg/m³

STEL:

Ceiling:

Notes: [*Note: The PEL applies to all Cadmium compounds (as Cd).] [1910.1027]

Chemical and Physical Properties

Molecular Weight: 112.4

Solubility: Insoluble

Vapor Pressure: 0 mmHg (approximately)

Specific Gravity: 8.65 (metal)

Boiling Point: 1409°F

RGAsD:

Melting Point: 610°F

MEC:

Flash Point: NA

Ionization Potential: NA

Upper Explosive Limit: NA

Lower Explosive Limit: NA

Flammability: Metal: Noncombustible Solid in bulk form, but will burn in powder form.

Physical Description: Metal: Silver-white, blue-tinged lustrous, odorless solid.

Incompatibilities and Reactivities: Strong oxidizers; elemental sulfur, selenium & tellurium

Measurement Methods

Collection Method: Particulate filter

Sample Work-up: Acid

Analytical Method: Flame atomic absorption spectrometry

Method Number: [#7048]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: No recommendation is made specifying the need for personal protective equipment for the body.

Eye Protection: No recommendation is made specifying the need for eye protection.

Workers should wash: The worker should wash daily at the end of each work shift.

Change work clothing: Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises.

Remove clothing: No recommendation is made specifying the need for removing clothing that becomes wet or contaminated.

The following equipment should be available: NO RECOMMENDATION GIVEN

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Ingestion

Symptoms of Exposure: Pulmonary edema, dyspnea, cough, chest tightness, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia; carcinogen

Organs affected by exposure to this substance are: Respiratory system, kidneys, prostate, blood [prostatic & lung cancer]

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, wash the contaminated skin with soap and water.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Methylene chloride 75-09-2

Structure: CH₂Cl₂

Conversion Factor: 1 ppm = 3.47 mg/m³

RTECS Number: PA8050000

DOT ID and Guide Number: 1593 160

Synonyms and Trade Names: Dichloromethane, Methylene dichloride

Exposure Limits and IDLH

IDLH: 2300 ppm

Odor Threshold: 160 ppm

NIOSH DATA

TWA: Ca, See Appendix A

STEL:

Ceiling:

Notes:

OSHA DATA

TWA: 25 ppm

STEL: 125 ppm

Ceiling:

Notes:

Chemical and Physical Properties

Molecular Weight: 84.9

Solubility: 2%

Vapor Pressure: 350 mmHg

Specific Gravity: 1.33

Boiling Point: 104°F

RGAsD:

Freezing Point: -139°F

MEC:

Flash Point: ?

Ionization Potential: 11.32 eV

Upper Explosive Limit: 23%

Lower Explosive Limit: 13%

Flammability:

Combustible Liquid

Physical Description: Colorless liquid with a chloroform-like odor. [Note: A gas above 104°F.]

Incompatibilities and Reactivities: Strong oxidizers; caustics; chemically-active metals such as aluminum, magnesium powders, potassium & sodium; concentrated nitric acid

Measurement Methods

Collection Method: Charcoal tube (Two are used in series.)

Sample Work-up: Carbon disulfide

Analytical Method: Gas chromatography with flame ionization detection

Method Number: [#1005]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet or significantly contaminated should be removed and replaced.

The following equipment should be available: Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility for exposure.

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Skin absorption; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, skin; Fatigue, Weakness, Somnolence, Lightheadedness; Numbness, tingle limbs; Nausea; Carcinogen

Organs affected by exposure to this substance are: Eyes, skin, Cardiovascular system, Central Nervous System [in animals: lung, liver, salivary & mammary gland tumors]

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Carbon disulfide 75-15-0

Structure: CS₂

Conversion Factor: 1 ppm = 3.11 mg/m³

RTECS Number: FF6650000

DOT ID and Guide Number: 1131 131

Synonyms and Trade Names: Carbon bisulfide

Exposure Limits and IDLH

IDLH: 500 ppm

Odor Threshold: 0.016-0.42 ppm

NIOSH DATA

TWA: 1 ppm (3 mg/m³)

STEL: 10 ppm (30 mg/m³) [skin]

Ceiling:

Notes:

OSHA DATA

TWA: See Appendix G for vacated 1989 OSHA PEL. 20 ppm

STEL:

Ceiling: 30 ppm 100 ppm (30-minute maximum peak)

Notes: 1989 OSHA PEL: TWA 4 ppm (12 mg/m³) ST 12 ppm (36 mg/m³) [skin]

Chemical and Physical Properties

Molecular Weight: 76.1

Solubility: 0.3%

Vapor Pressure: 297 mmHg

Specific Gravity: 1.26

Boiling Point: 116°F

RGAsD:

Freezing Point: -169°F

MEC:

Flash Point: -22°F

Ionization Potential: 10.08 eV

Upper Explosive Limit: 50.0%

Lower Explosive Limit: 1.3%

Flammability: Class IB Flammable Liquid

Physical Description: Colorless to faint-yellow liquid with a sweet ether-like odor. [Note: Reagent grades are foul smelling.]

Incompatibilities and Reactivities: Strong oxidizers; chemically-active metals such as sodium, potassium & zinc; azides; rust; halogens; amines [Note: Vapors may be ignited by contact with ordinary light bulb.]

Measurement Methods

Collection Method: Charcoal tube/Drying Filter

Sample Work-up: Toluene

Analytical Method: Gas chromatography with flame photometric detection for sulfur, nitrogen, or phosphorous

Method Number: [#1600]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100 degrees F).

The following equipment should be available: No recommendation given

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

***10 ppm:**

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)

(APF = 10) Any supplied-air respirator

***25 ppm:**

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

***50 ppm:**

(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

(APF = 50) Any powered, air-purifying respirator with tight-fitting facepiece and organic vapor cartridge(s)

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

***500 ppm:**

(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

***(Emergency or planned entry into unknown concentrations or IDLH conditions):**

(APF = 10,000) Any self-contained breathing apparatus that as a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

***Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Skin absorption; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Dizziness, Headache, poor sleep, Fatigue, Nervousness, anorexia, Weight loss; psychosis; Polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis, kidney, liver Injury; eye, skin burns; Dermatitis; Reproductive effects

Organs affected by exposure to this substance are: Central Nervous System, Peripheral nervous system, Cardiovascular system, eyes, kidneys, liver, skin, Reproductive system

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Lead 7439-92-1

Structure: Pb

Conversion Factor:

RTECS Number: OF7525000

DOT ID and Guide Number:

Synonyms and Trade Names: Lead metal, Plumbum

Exposure Limits and IDLH

IDLH: 100 mg/m³ (as Pb)

Odor Threshold: not given

NIOSH DATA

TWA: 0.100 mg/m³ See Appendix C

STEL:

Ceiling:

Notes: [*Note: The REL also applies to other lead compounds (as Pb) - see Appendix C.]

OSHA DATA

TWA: 0.050 mg/m³ See Appendix C

STEL:

Ceiling:

Notes: [*Note: The PEL also applies to other lead compounds (as Pb) - see Appendix C.], [1910.1025]

Chemical and Physical Properties

Molecular Weight: 207.2

Solubility: Insoluble

Vapor Pressure: 0 mmHg (approximately)

Specific Gravity: 11.34

Boiling Point: 3164°F

RGAsD:

Melting Point: 621°F

MEC:

Flash Point: NA

Ionization Potential: NA

Upper Explosive Limit: NA

Lower Explosive Limit: NA

Flammability: Noncombustible Solid in bulk form.

Physical Description: A heavy, ductile, soft, gray solid.

Incompatibilities and Reactivities: Strong oxidizers, hydrogen peroxide, acids

Measurement Methods

Collection Method: Particulate filter

Sample Work-up: Nitric acid/Hydrogen peroxide

Analytical Method: Flame atomic absorption spectrometry

Method Number: [#7082] [Also #7105, #7300]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should wash daily at the end of each work shift.

Change work clothing: Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises.

Remove clothing: Work clothing that becomes wet or significantly contaminated should be removed and replaced.

The following equipment should be available: No recommendation given

Recommendations for Respirator Selection

OSHA RECOMMENDATIONS

*0.5 mg/ m³:

(APF = 10) Any air-purifying respirator with a high-efficiency particulate filter

(APF = 10) Any supplied-air respirator

*1.25 mg/ m³:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter

*2.5 mg/ m³:

(APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

*50 mg/ m³:

(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

*100 mg/ m³:

(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

*(Emergency or planned entry into unknown concentrations or IDLH conditions):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Weakness, Lassitude, Insomnia; facial pallor; anorexia, Weight loss, Malnutrition; Constipation, abdominal pain, colic; anemia; gingival lead line; tremor; Paralysis wrist, ankles; encephalopathy; kidney disease; Irritation eyes; hypotension

Organs affected by exposure to this substance are: Eyes, Gastrointestinal tract, Central Nervous System, kidneys, blood, gingival tissue

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, promptly flush the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Trichloroethylene 79-01-6

Structure: ClCH=CCl2

Conversion Factor: 1 ppm = 5.37 mg/ m³

RTECS Number: KX4550000

DOT ID and Guide Number: 1710 160

Synonyms and Trade Names: Ethylene trichloride, TCE, Trichloroethene, Trilene

Exposure Limits and IDLH

IDLH: 1000 ppm

Odor Threshold: 82 ppm

NIOSH DATA

TWA: Ca, See Appendix A See Appendix C

STEL:

Ceiling:

Notes:

OSHA DATA

TWA: See Appendix G for vacated 1989 OSHA PEL. 100 ppm

STEL:

Ceiling: 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)

Notes: 1989 OSHA PEL: TWA 50 ppm (270 mg/ m³) ST 200 ppm (1080 mg/ m³)

Chemical and Physical Properties

Molecular Weight: 131.4

Solubility: 0.1%

Vapor Pressure: 58 mmHg

Specific Gravity: 1.46

Boiling Point: 189°F

RGAsD:

Freezing Point: -99°F

MEC:

Flash Point: ?

Ionization Potential: 9.45 eV

Upper Explosive Limit: (77°F): 10.5%

Lower Explosive Limit: (77°F): 8%

Flammability: Combustible Liquid, but burns with difficulty.

Physical Description: Colorless liquid (unless dyed blue) with a chloroform-like odor.

Incompatibilities and Reactivities: Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Measurement Methods

Collection Method: Charcoal tube

Sample Work-up: Carbon disulfide

Analytical Method: Gas chromatography with flame ionization detection

Method Number: [#1022]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet or significantly contaminated should be removed and replaced.

The following equipment should be available: Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility for exposure.

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Skin absorption; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, skin; headache, vertigo; visual disturbance, fatigue, giddiness, tremor, somnolence, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; carcinogen

Organs affected by exposure to this substance are: Eyes, skin, Respiratory system, heart, liver, kidneys, Central Nervous System [in animals: liver & kidney cancer]

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible

Swallow: If this chemical has been swallowed, get medical attention immediately.

Vinylidene chloride 75-35-4

Structure: CH₂=CCl₂

Conversion Factor:

RTECS Number: KV9275000

DOT ID and Guide Number: 1303 129P (inhibited)

Synonyms and Trade Names: 1,1-DCE; 1,1-Dichloroethene; 1,1-Dichloroethylene; VDC; Vinylidene chloride monomer; Vinylidene dichloride

Exposure Limits and IDLH

IDLH: N.D.

Odor Threshold: not given

NIOSH DATA

TWA: Ca, See Appendix A

STEL:

Ceiling:

Notes:

OSHA DATA

TWA: See Appendix G for vacated 1989 OSHA PEL. none

STEL:

Ceiling:

Notes: 1989 OSHA PEL: TWA 1 ppm (4 mg/m³)

Chemical and Physical Properties

Molecular Weight: 96.9

Solubility: 0.04%

Vapor Pressure: 500 mmHg

Specific Gravity: 1.21

Boiling Point: 89°F

RGAsD:

Freezing Point: -189°F

MEC:

Flash Point: -2°F

Ionization Potential: 10.00 eV

Upper Explosive Limit: 15.5%

Lower Explosive Limit: 6.5%

Flammability: Class IA Flammable Liquid

Physical Description: Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor.

Incompatibilities and Reactivities: Aluminum, sunlight, air, copper, heat [Note: Polymerization may occur if exposed to oxidizers, chlorosulfonic acid, nitric acid, or oleum. Inhibitors such as the monomethyl ether of hydroquinone are added to prevent polymerization.]

Measurement Methods

Collection Method: Charcoal tube

Sample Work-up: Carbon disulfide

Analytical Method: Gas chromatography with flame ionization detection

Method Number. [#1015]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100 degrees F).

The following equipment should be available: Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility for exposure.

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Skin absorption; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, skin, throat; Dizziness, Headache, Nausea, Dyspnea; liver, kidney Dysfunction; Pneumonitis; Carcinogen

Organs affected by exposure to this substance are: Eyes, skin, Respiratory system, Central Nervous System, liver, kidneys [in animals: liver & kidney tumors]

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, immediately flush the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Vinyl chloride 75-01-4

Structure: $\text{CH}_2=\text{CHCl}$

Conversion Factor: 1 ppm = 2.56 mg/m³

RTECS Number: KU9625000

DOT ID and Guide Number: 1086 116P

Synonyms and Trade Names: Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)

Exposure Limits and IDLH

IDLH: N.D.

Odor Threshold: 10-20 ppm

NIOSH DATA

TWA: Ca, See Appendix A

STEL:

Ceiling:

Notes:

OSHA DATA

TWA: 1 ppm

STEL:

Ceiling: 5 ppm [15-minute], [1910.1017]

Notes:

Chemical and Physical Properties

Molecular Weight: 62.5

Solubility: (77°F): 0.1%

Vapor Pressure: 3.3 atmospheres

Specific Gravity:

Boiling Point: 7°F

RGAsD: 2.21

Freezing Point: -256°F

MEC:

Flash Point: NA (Gas)

Ionization Potential: 9.99 eV

Upper Explosive Limit: 33.0%

Lower Explosive Limit: 3.6%

Flammability: Flammable Gas

Physical Description: Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. [Note: Shipped as a liquefied compressed gas.]

Incompatibilities and Reactivities: Copper, oxidizers, aluminum, peroxides, iron, steel [Note: Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]

Measurement Methods

Collection Method: Charcoal tube (Two are used in series)

Sample Work-up: Carbon disulfide

Analytical Method: Gas chromatography with flame ionization detection

Method Number: [#1007]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent the skin from becoming frozen from contact with the liquid or from contact with vessels containing the liquid.

Eye Protection: Wear appropriate eye protection to prevent eye contact with the liquid that could result in burns or tissue damage from frostbite.

Workers should wash: No recommendation is made specifying the need for washing the substance from the skin (either immediately or at the end of the work shift).

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100 degrees F).

The following equipment should be available: Quick drench facilities and or eyewash fountains should be provided within the immediate work area for emergency use where there is any possibility of exposure to liquids that are extremely cold or rapidly evaporating.

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Skin and/or eye contact (liquid)

Symptoms of Exposure: Weakness; abdominal pain, Gastrointestinal bleeding; enlarged liver; pallor or Cyanosis of extremities; liquid: frostbite; Carcinogen

Organs affected by exposure to this substance are: Liver, Central Nervous System, blood, Respiratory system, lymphatic system [liver cancer]

First Aid

Eye: If eye tissue is frozen, seek medical attention immediately; if tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of water for at least 15 minutes, occasionally lifting the lower and upper eyelids. If irritation, pain, swelling, lacrimation, or photophobia persist, get medical attention as soon as possible.

Skin: If frostbite has occurred, seek medical attention immediately; do NOT rub the affected areas or flush them with water. In order to prevent further tissue damage, do NOT attempt to remove frozen clothing from frostbitten areas. If frostbite has NOT occurred, immediately and thoroughly wash contaminated skin with soap and water.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: None given

Benzene 71-43-2

Structure: C₆H₆

Conversion Factor: 1 ppm = 3.19 mg/m³

RTECS Number: CY1400000

DOT ID and Guide Number: 1114 130

Synonyms and Trade Names: Benzol, Phenyl hydride

Exposure Limits and IDLH

IDLH: 500 ppm

Odor Threshold: 34-119 ppm

NIOSH DATA

TWA: 0.1 ppm

STEL: 1 ppm See Appendix A, Ca

Ceiling:

Notes:

OSHA DATA

TWA: 1 ppm

STEL: 5 ppm See Appendix F, [1910.1028]

Ceiling:

Notes:

Chemical and Physical Properties

Molecular Weight: 78.1

Solubility: 0.07%

Vapor Pressure: 75 mmHg

Specific Gravity: 0.88

Boiling Point: 176°F

RGAsD:

Freezing Point: 42°F

MEC:

Flash Point: 12°F

Ionization Potential: 9.24 eV

Upper Explosive Limit: 7.8%

Lower Explosive Limit: 1.2%

Flammability: Class IB Flammable Liquid

Physical Description: Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

Incompatibilities and Reactivities: Strong oxidizers, many fluorides & perchlorates, nitric acid

Measurement Methods

Collection Method: Charcoal tube

Sample Work-up: Carbon disulfide

Analytical Method: Gas chromatography with flame ionization detection

Method Number: [#1500, Hydrocarbons] [Also #3700, #1501]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100 degrees F).

The following equipment should be available:

Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection.

Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility for exposure.

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration):
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; skin absorption; ingestion; skin and/or eye contact

Symptoms of Exposure: Irritation eyes, skin, nose, respiratory system; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone marrow depressant/depression; carcinogen

Organs affected by exposure to this substance are: Eyes, skin, Respiratory system, blood, Central Nervous System, bone marrow [leukemia]

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Nitric acid 7697-37-2

Structure: HNO_3

Conversion Factor: 1 ppm = 2.58 mg/m³

RTECS Number: QU5775000

DOT ID and Guide Number: 1760 154 ($\leq 40\%$ acid); 2031 157 ($>40\%$ acid); 2032 157 (fuming)

Synonyms and Trade Names: Aqua fortis, Engravers acid, Hydrogen nitrate, Red fuming nitric acid (RFNA), White fuming nitric acid (WFNA)

Exposure Limits and IDLH

IDLH: 25 ppm

Odor Threshold: 0.27 ppm

NIOSH DATA

TWA: 2 ppm (5 mg/m³)

STEL: 4 ppm (10 mg/m³)

Ceiling:

Notes:

OSHA DATA

TWA: See Appendix G for vacated 1989 OSHA PEL. 2 ppm (5 mg/m³)

STEL:

Ceiling:

Notes: :1989 OSHA PEL: TWA 2 ppm (5 mg/m³) ST 4 ppm (10 mg/m³)

Chemical and Physical Properties

Molecular Weight: 63.0

Solubility: Miscible

Vapor Pressure: 48 mmHg

Specific Gravity: (77°F): 1.50

Boiling Point: 181°F

RGAsD:

Freezing Point: -44°F

MEC:

Flash Point: NA

Ionization Potential: 11.95 eV

Upper Explosive Limit: NA

Lower Explosive Limit: NA

Flammability: Noncombustible Liquid, but increases the flammability of combustible materials.

Physical Description: Colorless, yellow, or red, fuming liquid with an acrid, suffocating odor. [Note. Often used in an aqueous solution. Fuming nitric acid is concentrated nitric acid that contains dissolved nitrogen dioxide.]

Incompatibilities and Reactivities: Combustible materials, metallic powders, hydrogen sulfide, carbides, alcohols [Note: Reacts with water to produce heat. Corrosive to metals.]

Measurement Methods

Collection Method: Silica gel tube (a special coating must be added)

Sample Work-up: Sodium bicarbonate/Sodium carbonate

Analytical Method: Ion chromatography

Method Number: [#7903, Inorganic Acids]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet or significantly contaminated should be removed and replaced.

The following equipment should be available: Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances (pH<2.5) Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure to the substances (pH<2.5)

Recommendations for Respirator Selection

NIOSH/OSHA RECOMMENDATIONS

*25 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(Substance reported to cause eye irritation or damage; may require eye protection)

(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern

(Only nonoxidizable sorbents are allowed (not charcoal))

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern

(Only nonoxidizable sorbents are allowed (not charcoal))

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

*(Emergency or planned entry into unknown concentrations or IDLH conditions):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern

(Only nonoxidizable sorbents are allowed (not charcoal))

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, skin, mucous membrane; delayed Pulmonary edema, Pneumonitis, Bronchitis; dental erosion

Organs affected by exposure to this substance are: Eyes, skin, Respiratory system, teeth

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, immediately flush the contaminated skin with water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. Get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Methyl alcohol 67-56-1

Structure: CH₃OH

Conversion Factor: 1 ppm = 1.31 mg/m³

RTECS Number: PC1400000

DOT ID and Guide Number: 1230 131

Synonyms and Trade Names: Carbinol, Columbian spirits, Methanol, Pyroligneous spirit, Wood alcohol, Wood naphtha, Wood spirit

Exposure Limits and IDLH

IDLH: 6000 ppm

Odor Threshold: 4.2-5960 ppm

NIOSH DATA

TWA: 200 ppm (260 mg/m³)

STEL: 250 ppm (325 mg/m³) [skin]

Ceiling:

Notes:

OSHA DATA

TWA: See Appendix G for vacated 1989 OSHA PEL. 200 ppm (260 mg/m³)

STEL:

Ceiling:

Notes: :1989 OSHA PEL: TWA 200 ppm (260 mg/m³) ST 250 ppm (325 mg/m³) [skin]

Chemical and Physical Properties

Molecular Weight: 32.1

Solubility: Miscible

Vapor Pressure: 96 mmHg

Specific Gravity: 0.79

Boiling Point: 147°F

RGAsD:

Freezing Point:-144°F

MEC:

Flash Point: 52°F

Ionization Potential: 10.84 eV

Upper Explosive Limit: 36%

Lower Explosive Limit: 6.0%

Flammability: Class IB Flammable Liquid

Physical Description: Colorless liquid with a characteristic pungent odor.

Incompatibilities and Reactivities: Strong oxidizers

Measurement Methods

Collection Method: Silica gel tube

Sample Work-up: Water/Isopropanol

Analytical Method: Gas chromatography with flame ionization detection

Method Number: [#2000, Methanol]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100 degrees F).

The following equipment should be available: No recommendation given

Recommendations for Respirator Selection

NIOSH/OSHA RECOMMENDATIONS

*2000 ppm:

(APF = 10) Any supplied-air respirator

*5000 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

*6000 ppm:

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

*(Emergency or planned entry into unknown concentrations or IDLH conditions):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Skin absorption; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, skin, upper Respiratory System; Headache, Drowsiness, Dizziness, Vertigo, Lightheadedness, Nausea, Vomiting; Visual Disturbance, optic nerve damage (blindness); Dermatitis

Organs affected by exposure to this substance are: Eyes, skin, respiratory system, central nervous system, gastrointestinal tract

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, flush the contaminated skin with water promptly. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water promptly. If irritation persists after washing, get medical attention.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Tantalum (metal and oxide dust, as Ta) 7440-25-7

Structure: Ta (metal)

Conversion Factor:

RTECS Number: WW5505000 (metal)

DOT ID and Guide Number:

Synonyms and Trade Names: Tantalum metal: Tantalum-181 Synonyms of other tantalum dusts (including oxide dusts) vary depending upon the specific compound.

Exposure Limits and IDLH

IDLH: 2500 mg/ m³ (as Ta)

Odor Threshold: not given

NIOSH DATA

TWA: 5 mg/ m³

STEL: 10 mg/ m³

Ceiling:

Notes:

OSHA DATA

TWA: 5 mg/ m³

STEL:

Ceiling:

Notes:

Chemical and Physical Properties

Molecular Weight: 180.9

Solubility: Insoluble

Vapor Pressure: 0 mmHg (approximately)

Specific Gravity: 16.65 (metal) 14.40 (powder)

Boiling Point: 9797°F

RGAsD:

Melting Point: 5425°F

MEC: <200 g/ m³Gu

Flash Point: NA

Ionization Potential: NA

Upper Explosive Limit: NA

Lower Explosive Limit: NA

Flammability: Metal: Combustible Solid; powder ignites SPONTANEOUSLY in air.

Physical Description: Metal: Steel-blue to gray solid or black, odorless powder.

Incompatibilities and Reactivities: Strong oxidizers, bromine trifluoride, fluorine

Measurement Methods

Collection Method: Particulate filter

Sample Work-up: none

Analytical Method: Gravimetric

Method Number: [#0500, Particulates NOR (total)]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: No recommendation is made specifying the need for personal protective equipment for the body.

Eye Protection: No recommendation is made specifying the need for eye protection.

Workers should wash: No recommendation is made specifying the need for washing the substance from the skin (either immediately or at the end of the work shift).

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: No recommendation is made specifying the need for removing clothing that becomes wet or contaminated.

The following equipment should be available: No recommendation given

Recommendations for Respirator Selection

NIOSH/OSHA RECOMMENDATIONS

***25 mg/ m³:**

(APF = 5) Any dust and mist respirator (If not present as a fume)

***50 mg/ m³:**

(APF = 10) Any dust and mist respirator except single-use and quarter-mask respirators

(If not present as a fume)

(APF = 10) Any dust, mist, and fume respirator

(APF = 10) Any supplied-air respirator

***125 mg/ m³:**

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered, air-purifying respirator with a dust and mist filter

(If not present as a fume)

***250 mg/ m³:**

(APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

***2500 mg/ m³:**

(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

***(Emergency or planned entry into unknown concentrations or IDLH conditions):**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

***Escape.**

(APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, skin; in animals: Pulmonary Irritation
Organs affected by exposure to this substance are: Eyes, skin, Respiratory system

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: none given

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: none given

n-Hexane 110-54-3

Structure: $\text{CH}_3[\text{CH}_2]_4\text{CH}_3$

Conversion Factor: 1 ppm = 3.53 mg/m³

RTECS Number: MN9275000

DOT ID and Guide Number: 1208 128

Synonyms and Trade Names: Hexane, Hexyl hydride, normal-Hexane

Exposure Limits and IDLH

IDLH: 1100 ppm [LEL]

Odor Threshold: 65-248 ppm

NIOSH DATA

TWA: 50 ppm (180 mg/m³)

STEL:

Ceiling:

Notes:

OSHA DATA

TWA: See Appendix G for vacated 1989 OSHA PEL. 500 ppm (1800 mg/m³)

STEL:

Ceiling:

Notes: :1989 OSHA PEL: TWA 50 ppm (180 mg/m³)

Chemical and Physical Properties

Molecular Weight: 86.2

Solubility: 0.002%

Vapor Pressure: 124 mmHg

Specific Gravity: 0.66

Boiling Point: 156°F

RGAsD:

Freezing Point: -219°F

MEC:

Flash Point: -7°F

Ionization Potential: 10.18 eV

Upper Explosive Limit: 7.5%

Lower Explosive Limit: 1.1%

Flammability: Class IB Flammable Liquid

Physical Description: Colorless liquid with a gasoline-like odor.

Incompatibilities and Reactivities: Strong oxidizers

Measurement Methods

Collection Method: Charcoal tube

Sample Work-up: Carbon disulfide

Analytical Method: Gas chromatography with flame ionization detection

Method Number: [#1500, Hydrocarbons]

References: NIOSH Manual of Analytical Methods (NMAM), 4th edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should immediately wash the skin when it becomes contaminated.

Change work clothing: No recommendation is made specifying the need for the worker to change clothing after the workshift.

Remove clothing: Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100 degrees F).

The following equipment should be available: No recommendation given

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*500 ppm:

(APF = 10) Any supplied-air respirator

(Substance reported to cause eye irritation or damage; may require eye protection)

*1100 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(Substance reported to cause eye irritation or damage; may require eye protection)

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

*(Emergency or planned entry into unknown concentrations or IDLH conditions):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Ingestion; Skin and/or eye contact

Symptoms of Exposure: Irritation eyes, nose; lightheadedness; nausea, headache; peripheral neuropathy: numbness extremities, muscle weakness; dermatitis; giddiness; chemical pneumonia (aspiration of liquid)

Organs affected by exposure to this substance are: Eyes, skin, Respiratory system, Central Nervous System, Peripheral nervous system

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.

Coal tar pitch volatiles 65996-93-2

Structure:

Conversion Factor:

RTECS Number: GF8655000

DOT ID and Guide Number:

Synonyms and Trade Names: Synonyms vary depending upon the specific compound (e.g., pyrene, phenanthrene, acridine, chrysene, anthracene & benzo(a)pyrene). [Note: NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products.]

Exposure Limits and IDLH

IDLH: 80 mg/m³

Odor Threshold: not given

NIOSH DATA

TWA: 0.1 mg/m³ (cyclohexane-extractable fraction) See Appendix A See Appendix C, Ca

STEL:

Ceiling:

Notes:

OSHA DATA

TWA: 0.2 mg/m³ (benzene-soluble fraction) [1910.1002] See Appendix C

STEL:

Ceiling:

Notes:

Chemical and Physical Properties

Molecular Weight:

Solubility:

Vapor Pressure:

Specific Gravity:

Boiling Point:

RGAsD:

Freezing Point:

MEC:

Flash Point:

Ionization Potential:

Upper Explosive Limit:

Lower Explosive Limit:

Flammability: Combustible Solids. Properties vary depending upon the specific compound.

Physical Description: Black or dark-brown amorphous residue.

Incompatibilities and Reactivities: Strong oxidizers

Measurement Methods

Collection Method: Particulate filter

Sample Work-up: Benzene

Analytical Method: Gravimetric

Method Number: [#58]

References: OSHA Analytical Methods Manual, 1990 edition

Personal Protection and Sanitation

Skin Protection: Wear appropriate personal protective clothing to prevent skin contact.

Eye Protection: Wear appropriate eye protection to prevent eye contact

Workers should wash: The worker should wash daily at the end of each work shift.

Change work clothing: Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises.

Remove clothing: No recommendation is made specifying the need for removing clothing that becomes wet or contaminated.

The following equipment should be available: No recommendation given

Recommendations for Respirator Selection

NIOSH RECOMMENDATIONS

*At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration):

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode

*Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter

Any appropriate escape-type, self-contained breathing apparatus

Health Hazards

Routes of Exposure: Inhalation; Skin and/or eye contact

Symptoms of Exposure: Dermatitis, Bronchitis, Carcinogen

Organs affected by exposure to this substance are: Respiratory system, skin, bladder, kidneys [lung, kidney & skin cancer]

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

Breath: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately.